



1966 OPERATING SUMMARY

OWRC WATER POLLUTION CONTROL PLANTS

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1966 OPERATING SUMMARY

Water Pollution Control Plants

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PREFACE

The Division of Plant Operations prepares annual reports on all staffed OWRC owned projects which have been in operation for at least one full year. The standardization of these reports led to the preparation of a summary report which would facilitate the comparison of the operating data for the various projects.

The first summary report for water pollution control plants was prepared in 1963. It included data from 6 primary plants and 21 secondary plants. The 1966 report summarizes and compares data from 13 primary plants and 35 secondary plants. The secondary plants consist of 29 conventional activated sludge plants, 5 extended aeration plants and 1 trickling filter plant.



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PLANTS INCLUDED IN REPORT

PRIMARY

			<u>Sludge Handling</u>	<u>Design Flow (MGD)</u>
1.	Belleville	61-S-84	Digestion	3.0
2.	Fort Erie	59-S-39	Digestion	1.8
3.	Fort Frances	60-S-59	Digestion	2.0
4.	Fort William	61-S-91	Digestion	6.0
5.	Midland	63-S-146	Digestion	1.25
6.	Owen Sound	60-S-68	Digestion	3.0
7.	Parry Sound	62-S-113	Digestion	0.83
8.	Point Edward	59-S-36	Digestion	0.57
9.	Port Arthur	58-S-13	Digestion	4.0
10.	Port Dover	62-S-115	Vacuum Filter	2.1
11.	Sault Ste. Marie	59-S-20	Vacuum Filter	8.0
12.	Timmins	60-S-71	Digestion	3.0
13.	Trenton	57-S-4	Digestion	1.0

CONVENTIONAL ACTIVATED SLUDGE

14.	Brampton/Chinguacousy	58-S-14	Digestion	2.0
15.	Brantford	58-S-11	Digestion, Vacuum Filtration	12.5
16.	Burlington DL	60-S-51	Digestion	2.5
17.	Burlington EG	58-S-28	Digestion	0.75
18.	Chatham	62-S-102	Digestion	4.5
19.	Ceniston	57-S-8	Digestion	0.260
20.	Elmira	61-S-96	Digestion	0.68
21.	Fergus	58-S-23	Digestion	0.6
22.	Galt	61-S-90	Digestion, Vacuum Filtration	5.0
23.	Georgetown	58-S-17	Digestion	1.5
24.	Huntsville	58-S-15	Digestion	0.25
25.	Kingston Twp.	61-S-98	Digestion	0.83
26.	Kitchener	58-S-19	Digestion, Vacuum Filtration	13.5
27.	Lakeview	59-S-43	Digestion	5.0
28.	Markham Village	59-S-40	Digestion	0.334
29.	Nepean Twp.	59-S-35	Digestion	1.500
30.	Newmarket/East Gwillimbury	61-S-87	Digestion	2.0
31.	North Bay	58-S-10	Digestion	4.0
32.	Orangeville	58-S-16	-	0.75 (Prim.), 0.25 (Sec.).
33.	Port Colborne E.	-	Digestion	0.85
34.	Port Colborne W.	59-S-47	Digestion	0.9
35.	Preston	59-S-46	Vacuum Filtration	1.8
36.	Richmond Hill	57-S-6	Digestion	1.6
37.	Sidney Twp.	62-S-121	Digestion	0.12

			<u>Sludge Handling</u>	<u>Design Flow (MGD)</u>
38.	Simcoe	62-S-120	Digestion	1.4
39.	Stratford	57-S-2	Digestion	4.0
40.	Streetsville	57-S-5	Digestion	0.8
41.	Tillsonburg	58-S-12	Digestion	0.67
42.	Waterloo	58-S-22	Vacuum Filtration	4.0

EXTENDED AERATION

43.	Burlington Skyway	62-S-105	Holding Tank, decanted	3.125
44.	Elora	62-S-125	Holding Tank,	0.083
45.	Moore Twp.	61-S-88	Holding Tank, decanted	0.320
46.	Paris	59-S-34	Holding Tank	0.50
47.	Westminster	59-S-33	Holding Tank, decanted	0.25

TRICKLING FILTER

48.	Frankford	58-S-9		0.54
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GRIT REMOVAL

The average grit removal during 1966 was 2.3 cubic feet per million gallons of sewage as compared to 2.6 cubic feet per million gallons of sewage during 1963 and 1964. The monthly values ranged from a high of 14.9 cubic feet per million gallons of sewage at Parry Sound to less than 0.1 cubic feet per million gallons of sewage at Galt. During 1966 Elmira, Elora, Nepean Twp., and Newmarket did not report grit removal quantities. Since routine analysis for volatile matter in the material removed by the grit facilities is not performed all material removed was considered to be grit. Figure 1 summarizes the average yearly and maximum monthly grit removal in cubic feet per million gallons of sewage for all plants.

PRIMARY PLANTS

SECONDARY PLANTS

PARRY SOUND
PORT DOVER
MIDLAND
POINT EDWARD
FORT WILLIAM
TRENTON
TIMMINS
SAULT STE. MARIE
PORT ARTHUR
OWEN SOUND
BELLEVILLE
FORT FRANCES
FORT ERIE

CONISTON
BRAMPTON / CHINGUACOUSY
MOORE TWP.
NORTH BAY
CHATHAM
ORANGEVILLE
BURLINGTON SKYWAY
RICHMOND HILL
BRANTFORD
HUNTSVILLE
KITCHENER
WATERLOO
BURLINGTON E.G.
KINGSTON TWP.
TILLSONBURG
MARKHAM VILLAGE
STREETSVILLE
STRATFORD
FERGUS
SIMCOE
PORT COLBORNE E.
GEORGETOWN
PRESTON
BURLINGTON D.L.
SIDNEY TWP.
LAKEVIEW
PORT COLBORNE W.
GALT

GRIT REMOVED CU. FT. / M.G.

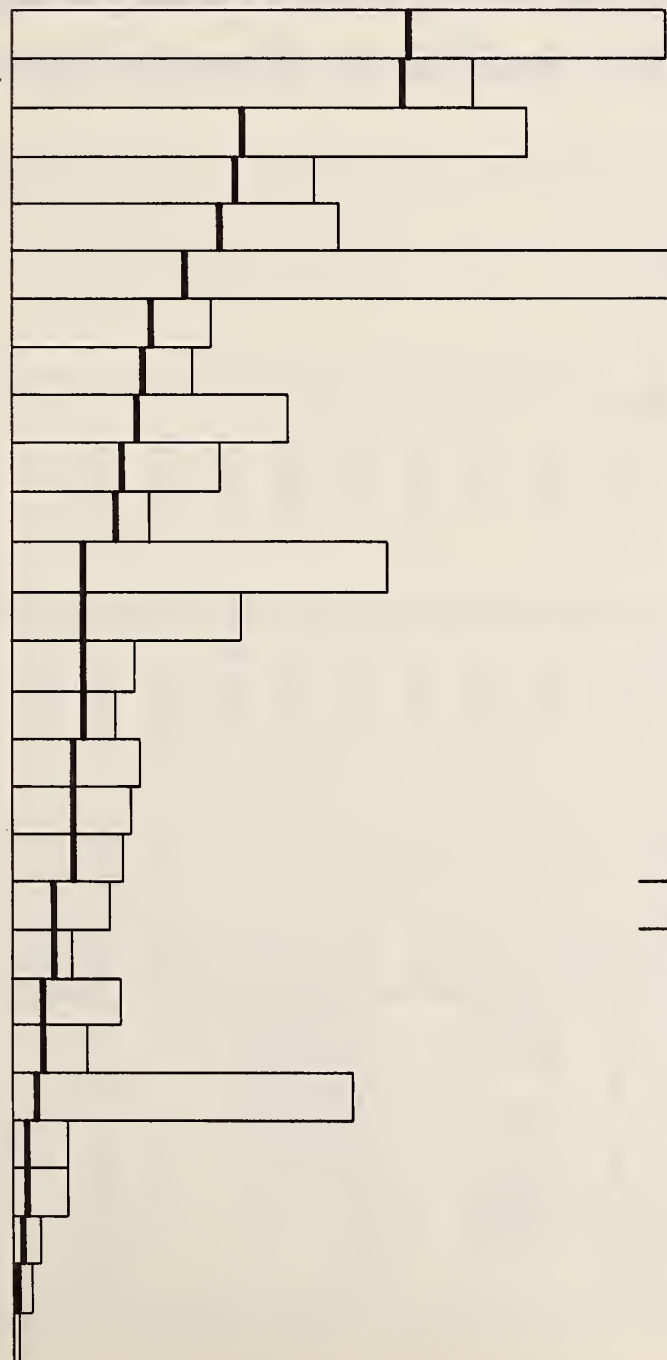
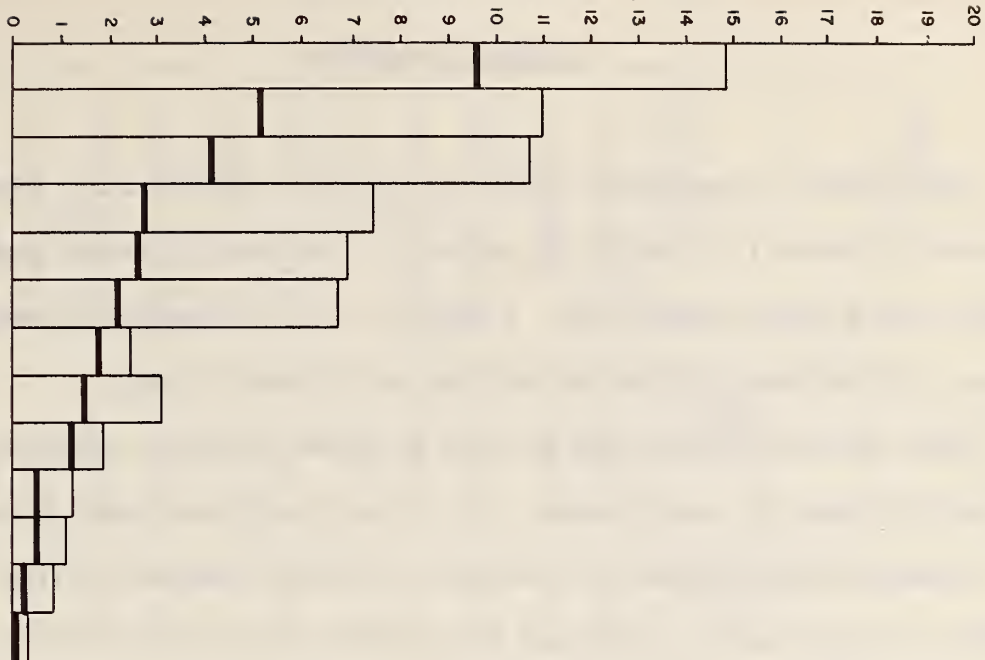
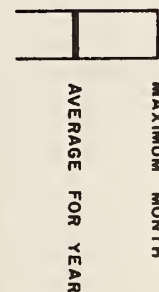


FIGURE No. 1
GRIT REMOVAL
YEARLY AVERAGE - 1966



PLANT LOADINGS

The hydraulic, biochemical oxygen demand and suspended solids loadings are summarized in Tables I, II, and III for primary, conventional activated sludge and extended aeration plants respectively. Figures 2, 3, and 4 graphically display the hydraulic, BOD and suspended solids loadings as a percent of design.

These statistics indicate that 29 of the 48 plants are either closely approaching or are overloaded in some respect. Two of the grossly overloaded secondary plants, Brampton/Chinguacousy and Lakeview, underwent expansion during 1966. In addition, design reports or plans and specifications were received for the modification or expansion of 10 other plants including Belleville, Fergus, Markham Village, Nepean Twp., North Bay, Orangeville, Port Colborne East, Richmond Hill, Tillsonburg and Waterloo.

PRIMARY PLANT LOADINGS

HYDRAULIC, BOD AND SUSPENDED SOLIDS

TABLE I

1966

PROJECT	DESIGN FLOW MGD.	AVG. DAILY FLOW MGD.	AVG. DAILY FLOW AS % OF DESIGN	% OF TIME AVG. FLOW GREATER THAN DESIGN	MAX. DAILY FLOW RECORDED MGD.	AVG. DAILY FLOW FOR PEAK MTH MGD.	LOADING AS % OF DESIGN		REMARKS
							BOD	SS	
BELLEVILLE	3.000	5.463	182	100	10.000	7.390	55	144	Gross Overload
FORT ERIE	1.800	1.650	92	31	5.150	2.530	30	73	Approaching Hyd. Overload
FORT FRANCES	2.000	2.089	104	54	4.451	3.206	57	65	Hyd. Overload
FORT WILLIAM	6.000	2.727	45	3	7.210	5.343	19	19	
MIDLAND	1.250	1.008	81	25	3.330	1.351	48	40	Approaching Hyd. Overload
OWEN SOUND	3.000	3.195	106	50	8.800	4.597	59	96	Hyd. & SS. Overload
PARRY SOUND	0.830	0.635	76	12	2.509	0.844	30	55	
POINT EDWARD	0.570	0.208	36	0	0.365	0.244	45	42	
PORT ARTHUR	4.000	5.001	125	96	7.910	7.363	104	144	Gross Overload
PORT DOVER	2.100	0.350	17	0	1.570	0.532	25	10	
SAULT STE. MARIE	8.000	7.312	91	25	19.380	10.271	28	66	Approaching Hyd. Overload
TIMMINS	3.000	3.099	103	64	5.971	3.693	108	109	Overload in all respects
TRENTON	1.000	0.640	64	17	3.120	1.481	73	69	

CONVENTIONAL A.S. PLANT LOADINGS
HYDRAULIC, BOD AND SUSPENDED SOLIDS

1966

TABLE II

PROJECT	DESIGN FLOW MGD	AVERAGE DAILY FLOW MGD	AVG. DAILY FLOW AS % OF DESIGN	% OF TIME AVG. DAILY FLOW GREATER THAN DESIGN %	MAX. DAILY FLOW RECORDED MGD	AVG. DAILY FLOW FOR PEAK MONTH MGD	LOADING AS % OF DESIGN 800 SS	REMARKS
BRANTFORD	12.500	6.823	54	0	10.813	9.207	72	75
BRAMPTON/CHINGUACOUSY	2.000	2.621	131	91	3.764	2.991	223	405
BURLINGTON DL	2.500	1.585	63	3	3.160	2.727	75	98
BURLINGTON EG	0.750	0.816	109	54	2.540	1.489	63	67
CHATHAM	4.500	1.965	44	1	4.700	3.110	46	38
CONISTON	0.260	0.173	66	54	0.430	0.236	71	59
ELMIRA	0.680	0.556	82	26	2.727	1.071	59	46
FERGUS	0.600	0.600	100	43	1.364	0.874	125	86
GALT	5.000	5.216	104	65	8.320	5.697	68	77
GEORGETOWN	1.500	0.996	66	7	2.390	1.367	29	56
HUNTSVILLE	0.250	0.267	107	56	0.591	0.351	63	49
KINGSTON	0.830	0.512	62	6	1.321	0.699	61	54
KITCHENER	13.500	9.473	70	3	15.300	11.419	55	53
LAKEVIEW	5.000	7.965	159	99		10.199	188	210
MARKHAM VILLAGE	0.334	0.478	143	99	0.900	0.619	124	140
NEPEAN TOWNSHIP	1.500	2.768	184	100	3.789	3.241	64	55
NEWMARKET	2.000	1.500	75	3	2.598	1.725	72	153
NORTH BAY	4.000	3.798	95	50	6.814	5.011	76	80
*ORANGEVILLE	0.750 (0.250)	0.574	76	16	0.940	0.756	60	55
PORT COLBORNE E	0.850	0.892	105	45	3.020	1.368	No CRITERIA	ARY CAPACITY
PORT COLBORNE W	0.900	0.979	109	52	2.297	1.454	9*	8*
PRESTON	1.800	0.923	51	1	1.894	1.183	78	86
RICHMOND HILL	1.600	1.626	102	56	3.042	2.202	88	120
SIDNEY TOWNSHIP	0.120	0.185	154	94	0.290	0.240	55	68
SIMCOE	2.000	1.722	86	15	2.475	1.901	138	119
STRAITFORD	4.000	3.071	77	16	16.190	4.522	139	81
STREETSVILLE	0.800	0.546	68	6	1.666	0.714	103	86
TILLSONBURG	0.665	0.731	110	81	1.178	0.954	104	100
WATERLOO	4.000	3.123	78	7	4.943	3.741	80	74
**FRANKFORD	0.270	0.154	57	-	-	-	51	34

* ORANGEVILLE CALCULATIONS BASED ON PRIMARY CAPACITY. SECONDARY CAPACITY ONLY 0.25 MGD.

** TRICKLING FILTER. FRANKFORD FLOWS ARE ESTIMATED ON 134 DAYS DATA WITHOUT RECIRCULATION THROUGH METER

OWRC WATER POLLUTION CONTROL PLANTS
EXTENDED AERATION PLANT LOADINGS
HYDRAULIC, BOD AND SUSPENDED SOLIDS

TABLE III

1966

PROJECT	DESIGN FLOW MGD.	AVERAGE DAILY FLOW MGD.	AVG. DAILY FLOW AS % OF DESIGN	% OF TIME AVG. DAILY FLOW GREATER THAN DESIGN	MAX. DAILY FLOW RECORDED MGD.	AVG. DAILY FLOW FOR PEAK MTH. MGD.	LOADINGS AS % OF DESIGN		REMARKS
							BOD	SS	
BURLINGTON SKYWAY	3.125	2.771	89	34	4.322	3.458	82	91	Approaching Overload
ELORA	0.083	0.050	60	4	0.103	0.071	69	112	
MOORE TWP.	0.320	0.085	26	0	0.302	0.120	30	35	
PARIS	0.500	0.466	93	40	1.350	0.542	70	78	
WESTMINSTER	0.250	0.180	72	19	0.356	0.234	26	31	Approaching Hyd. Overload

FIGURE N° 2
AVERAGE HYDRAULIC LOAD AS PERCENT OF DESIGN FLOW

1966

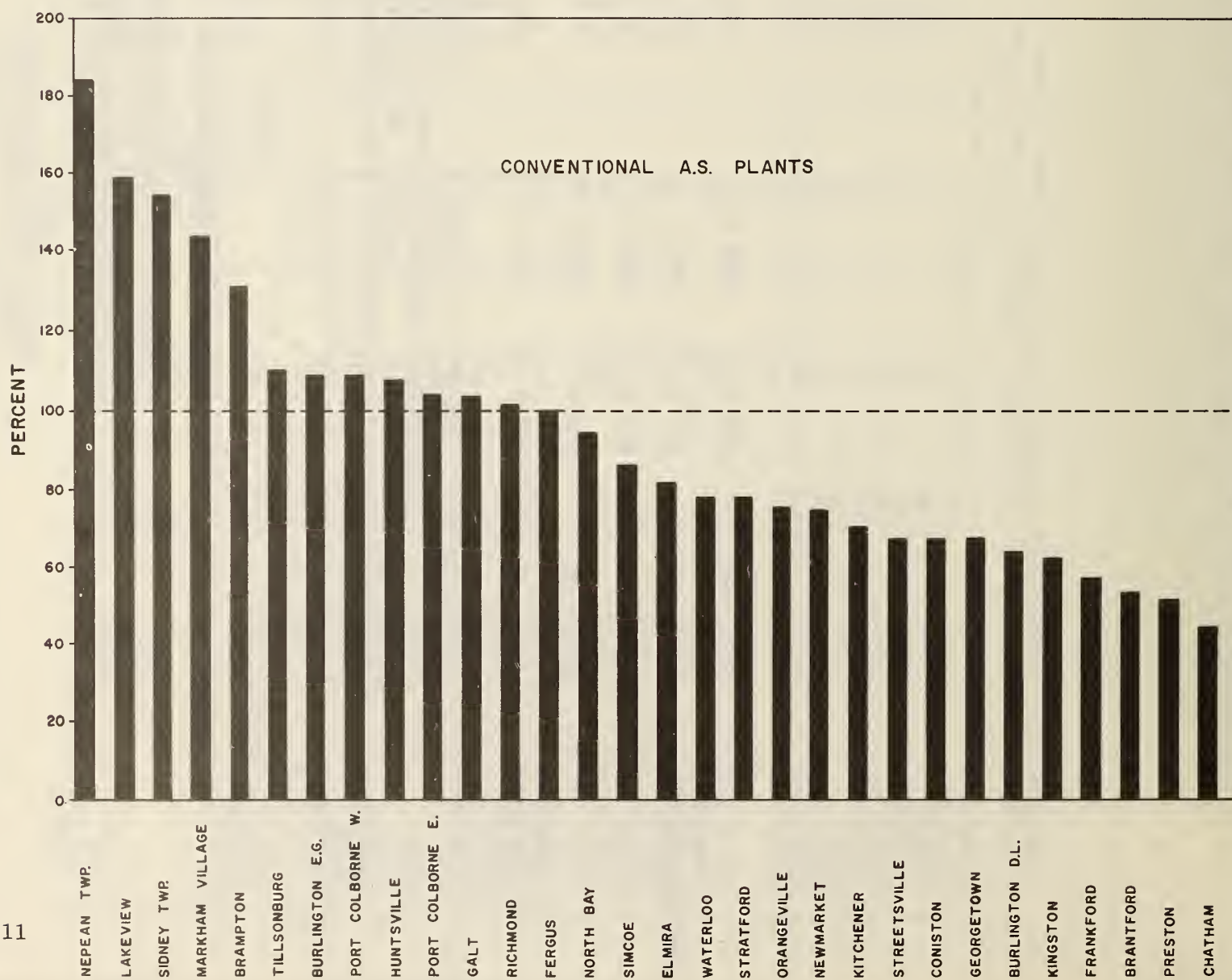
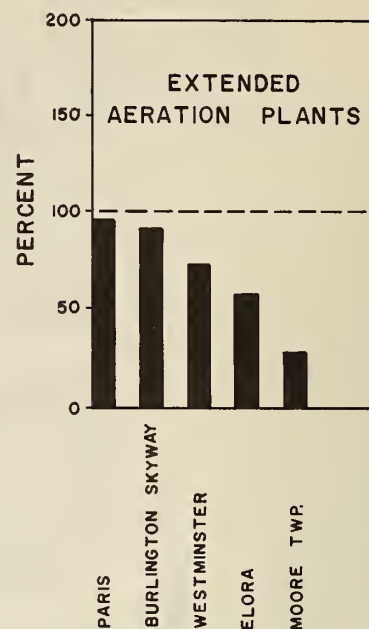
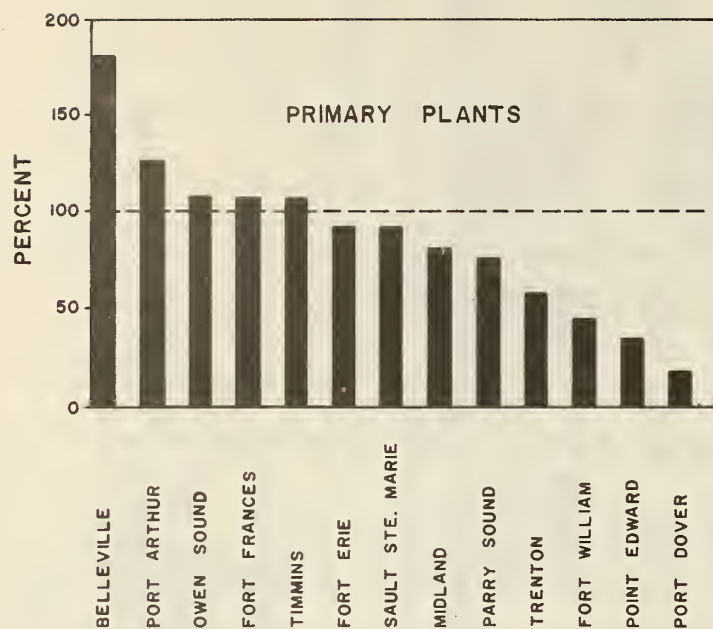


FIGURE N° 3
AVERAGE B.O.D. LOAD AS PERCENT OF DESIGN
1966

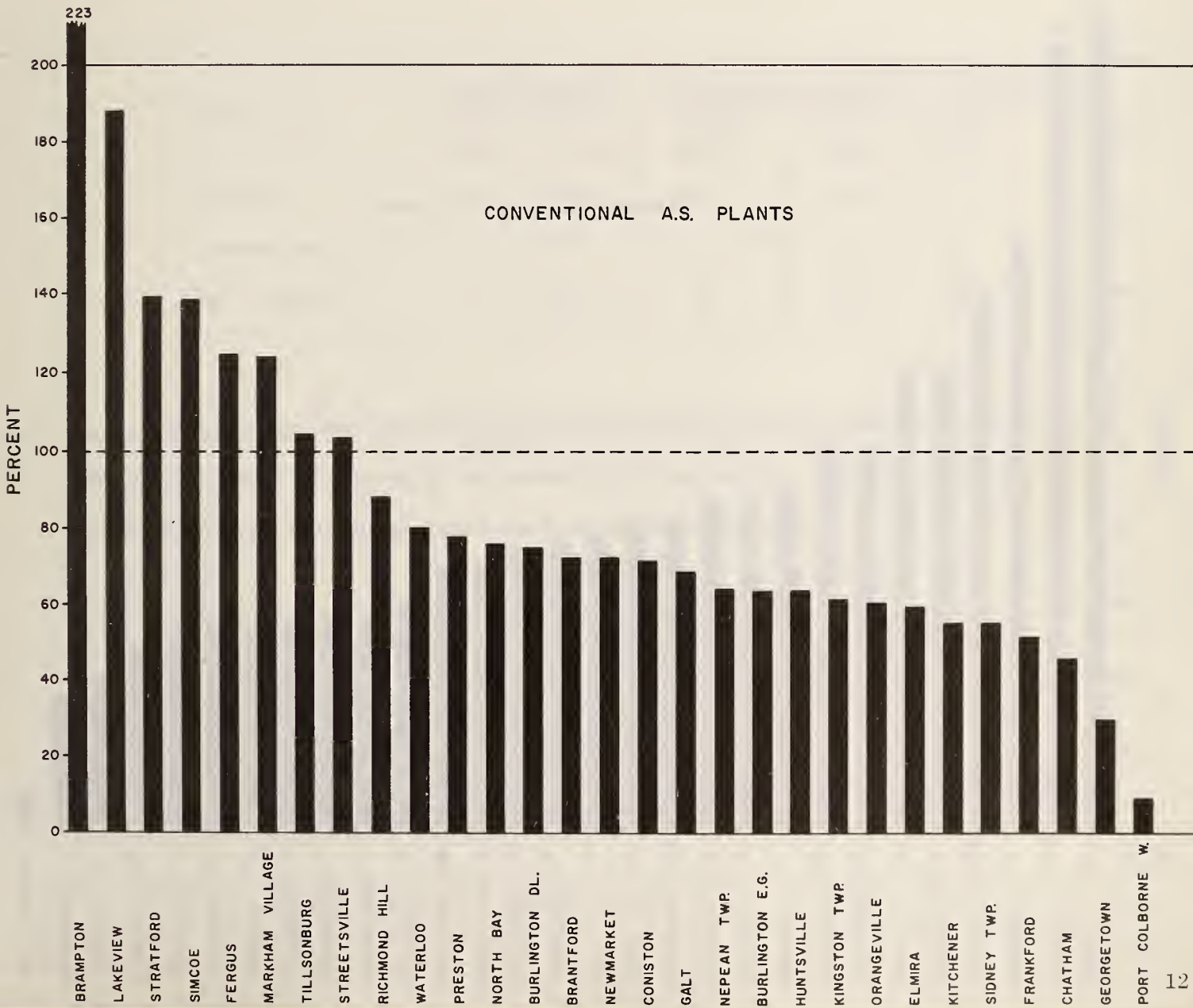
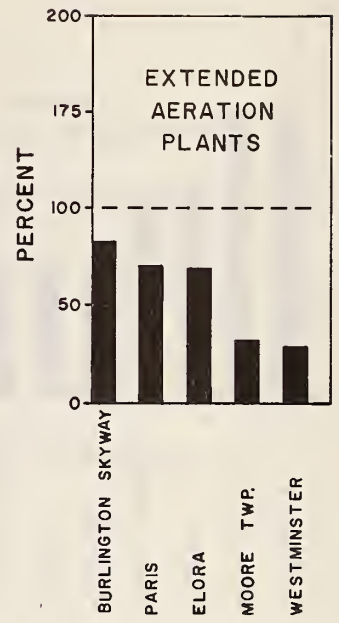
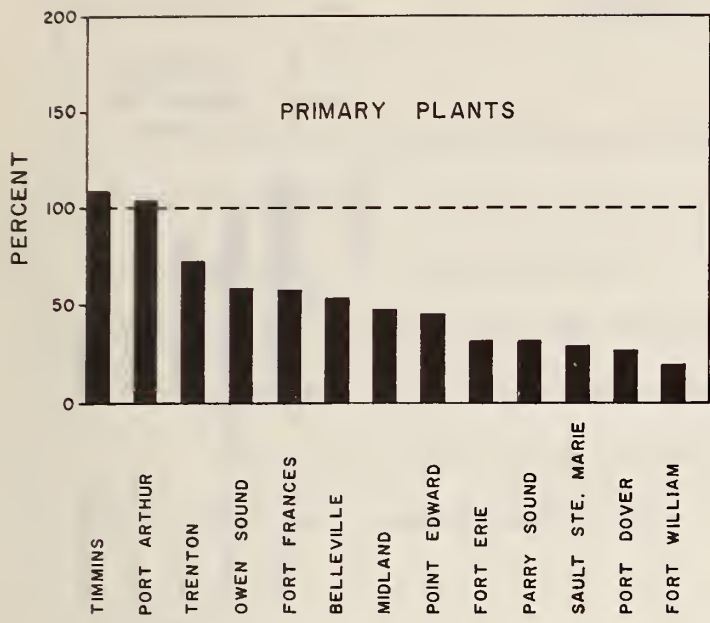
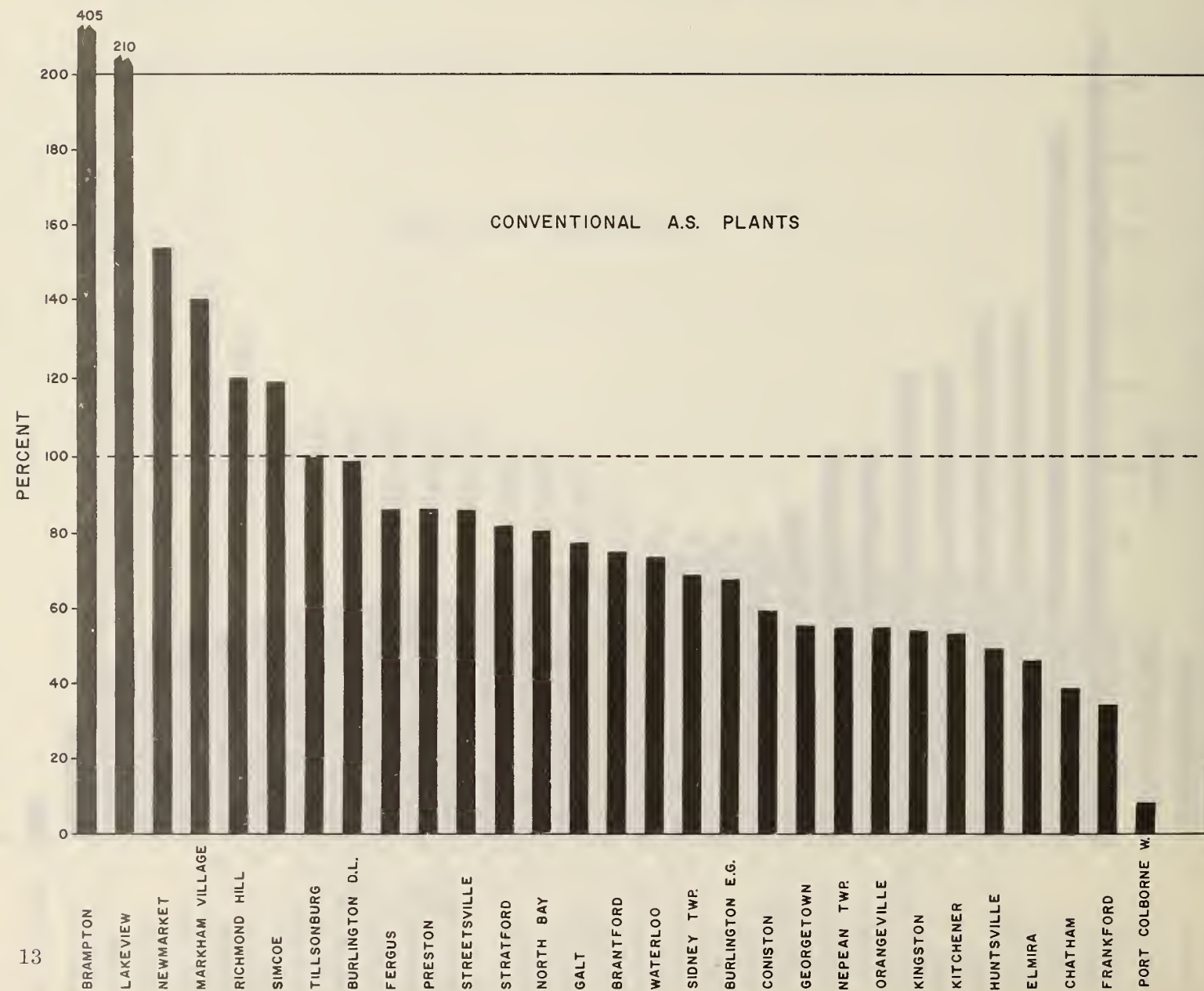
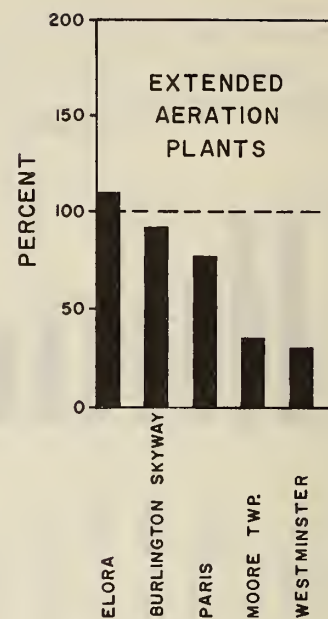
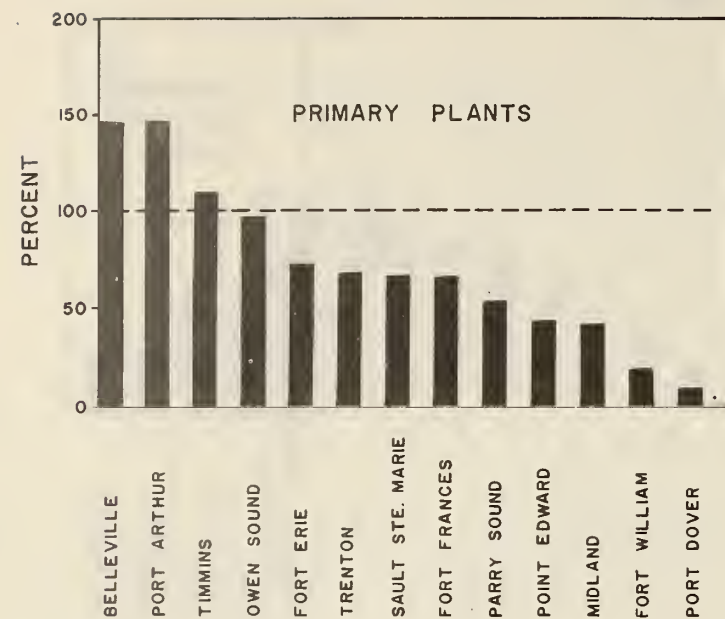


FIGURE N° 4
AVERAGE S.S. LOAD AS PERCENT OF DESIGN
1966



REMOVAL EFFICIENCY

Tables V, VI and VII summarize the range and average BOD and suspended solids removals for primary, conventional activated sludge and extended aeration plants respectively. Also included are average BOD and suspended solids concentrations of the influent raw sewage and plant effluent.

Figures 5, 6, 7 and 8 present graphically the values in the above tables.

A summary of the average concentrations and removals for the three types of plants is given in the following table.

TABLE IV

Plant Type	RAW SEWAGE		FINAL EFFLUENT		REMOVAL	
	BOD mg/l ⁵	SS mg/l	BOD mg/l ⁵	SS mg/l	BOD % ⁵	SS 5
Primary	142	168	64	64	53	61
Conventional A. S.	211	247	20	22	88	88
Ext. Aeration	166	238	8	12	95	95

The average removal efficiencies for both primary and extended aeration plants are greater than would normally be expected while the average removal efficiencies of conventional activated sludge plants are slightly less than normal.

CONCENTRATION AND REMOVAL EFFICIENCY

1966

PROJECT	BIOCHEMICAL OXYGEN DEMAND									SUSPENDED SOLIDS								
	RAW (MG/L)			FINAL (MG/L)			REMOVAL %			RAW (MG/L)			FINAL (MG/L)			REMOVAL %		
	MAX	MIN	AVG.	MAX	MIN	AVG.	MAX	MIN	AVG.	MAX	MIN	AVG.	MAX	MIN	AVG.	MAX	MIN	AVG.
TABLE V-PRIMARY																		
1. BELLEVILLE	98	38	76	59	13	43	66	43	44	260	78	158	130	25	84	70	10	47
2. FORT ERIE	92	40	63	71	24	40	46	0	36	420	46	104	92	22	55	82	12	47
3. FORT FRANCES	122	52	71	68	24	34	64	44	52	154	70	112	22	22	22	86	69	80
4. FORT WILLIAM	93	62	77	72	24	43	50	37	44	156	54	103	98	43	69	36	29	33
5. MIDLAND	250	56	133	80	35	56	74	20	58	316	76	149	83	34	64	74	6	57
6. OWEN SOUND	350	46	100	94	12	43	70	33	57	392	44	181	106	16	55	88	19	70
7. PARRY SOUND	202	43	100	82	24	52	68	12	48	306	57	143	80	20	46	86	26	68
8. POINT EDWARD	300	160	209	180	85	130	54	18	38	344	98	228	106	58	72	74	16	68
9. PORT ARTHUR	295	54	149	150	22	58	85	24	61	424	120	254	108	37	69	86	54	73
10. PORT DOVER	600	94	319	410	8	135	74	40	58	312	96	187	150	19	72	78	30	62
11. SAULT STE. MARIE	148	54	78	59	9	33	83	14	58	294	68	145	152	16	55	86	18	62
12. TIMMINS	700	50	189	160	34	62	86	26	67	1110	13	211	410	30	85	87	0	60
13. TRENTON	410	130	284	165	56	109	76	47	62	343	128	215	97	38	79	72	42	63
AVERAGE	282	68	142	127	28	64	69	28	53	372	74	168	126	29	64	77	25	61
TABLE VI-SECONDARY																		
14. BRANTFORD	395	158	224	66	17	31	94	73	86	438	170	241	52	4	19	98	78	92
15. BRAMPTON/CHING.	620	132	375	26	10	23	97	59	94	1792	230	773	60	11	33	99	82	96
16. BURLINGTON DL	620	76	238	36	4	14	98	83	94	600	147	310	25	2	9	99	94	97
17. BURLINGTON EG	320	21	127	62	3	20	95	72	84	358	32	153	35	1	11	97	83	93
18. CHATHAM	580	110	261	48	3	17	97	79	94	676	37	216	97	3	26	96	83	88
19. COMISTON	290	80	213	66	21	39	98	74	82	312	102	223	80	36	49	88	62	78
20. ELMIRA	640	52	301	260	5	60	93	22	80	558	36	171	580	8	76	80	36	56
21. FERGUS	1270	86	250	51	3	15	98	74	94	420	62	173	59	3	14	98	78	92
22. GALT	270	98	164	37	3	14	96	81	92	344	116	184	52	2	19	98	63	90
23. GEORGETOWN	140	64	88	33	6	16	90	76	82	416	106	210	80	5	24	95	74	88
24. HUNTSVILLE	380	26	148	20	2	9	97	35	94	192	24	114	24	4	12	98	20	89
25. KINGSTON TWP.	495	56	208	170	3	21	98	74	90	502	84	219	202	1	19	99	64	92
26. KITCHENER	290	140	236	28	5	14	98	90	94	726	240	338	28	4	18	97	87	94
27. LAKEVIEW	560	120	266	156	6	53	95	57	80	684	122	330	220	11	71	92	52	78
28. MARKHAM VILL.	350	118	186	200	7	46	95	23	75	382	152	245	170	14	58	94	12	76
29. NEPEAN TWP.	76	25	49	43	10	28	74	0	43	121	56	88	84	16	48	76	13	46
30. NEWMARKET	290	58	211	68	4	21	99	43	90	714	126	433	50	7	20	98	89	96
31. NORTH BAY	250	37	120	30	5	14	96	49	88	470	94	169	66	2	27	94	49	84
32. ORANGEVILLE	240	80	156	144	11	58	89	26	63	294	108	180	82	36	62	75	28	66
33. PORT COLBORNE E	500	25	112	60	4	20	90	52	82	512	14	137	92	5	22	92	15	84
34. PORT COLBORNE W	205	31	71	28	2	8	94	78	88	302	28	84	38	1	6	97	85	93
35. PRESTON	855	240	456	72	0	11	99+	90	98	1368	142	585	28	0	10	99	97	98
36. RICHMOND HILL	340	76	174	31	5	13	98	59	92	594	110	259	28	4	13	99	69	95
37. SIDNEY TWP.	200	23	78	41	3	12	97	45	84	269	29	110	96	2	17	97	24	84
38. SIMCOE (PLANT #1)	1610	82	276	15	2	8	99	95	97	1732	96	328	36	0	10	99	84	97
39. SIMCOE (PLANT #2)	500	88	233	28	4	10	98	91	96	234	108	175	20	3	12	98	90	93
40. STRATFORD	780	86	253	32	2	10	98	77	96	740	71	264	42	1	8	99	88	97
41. STRETSVILLE	780	108	362	30	5	10	99	88	97	544	156	323	22	2	11	99	91	96
42. TILLSONBURG	810	166	222	46	2	11	99	88	95	752	124	228	50	1	15	97	85	94
43. WATERLOO	775	125	306	58	7	24	96	90	92	470	32	257	55	2	27	96	76	89
44. * FRANKFORD	530	49	181	69	19	35	85	40	80	368	56	145	32	4	19	95	69	87
AVERAGE	492	82	211	61	6	20	96	66	88	584	96	247	79	5	22	96	67	88

* TRICKLING FILTER
AVERAGE EXCLUDES LAKEVIEW AND ORANGEVILLE. THESE PLANTS WERE NOT GIVING FULL SECONDARY TREATMENT DURING 1966.

TABLE VII-EXTENDED AERATION PLANTS																		
45. BURLINGTON SKY.	430	68	186	27	2	6	99	73	96	642	87	206	17	1	9	99+	88	95
46. ELORA	1150	69	241	28	2	12	98	79	95	3600	74	469	34	1	13	99	83	97
47. MOORE TWP.	250	110	170	26	2	9	99	86	94	328	110	196	51	3	18	97	82	91
48. PARIS	260	33	140	11	1	4	99	90	97	314	60	147	18	3	8	98	88	94
49. WESTMINSTER	260	25	91	46	1	8	98	74	91	434	70	172	50	1	14	97	82	92
AVERAGE	470	61	166	28	2	8	99	80	95	1064	80	238	34	2	12	98	85	95

FIGURE N° 5
BIOCHEMICAL OXYGEN DEMAND AND SUSPENDED SOLIDS
PRIMARY PLANTS
1966

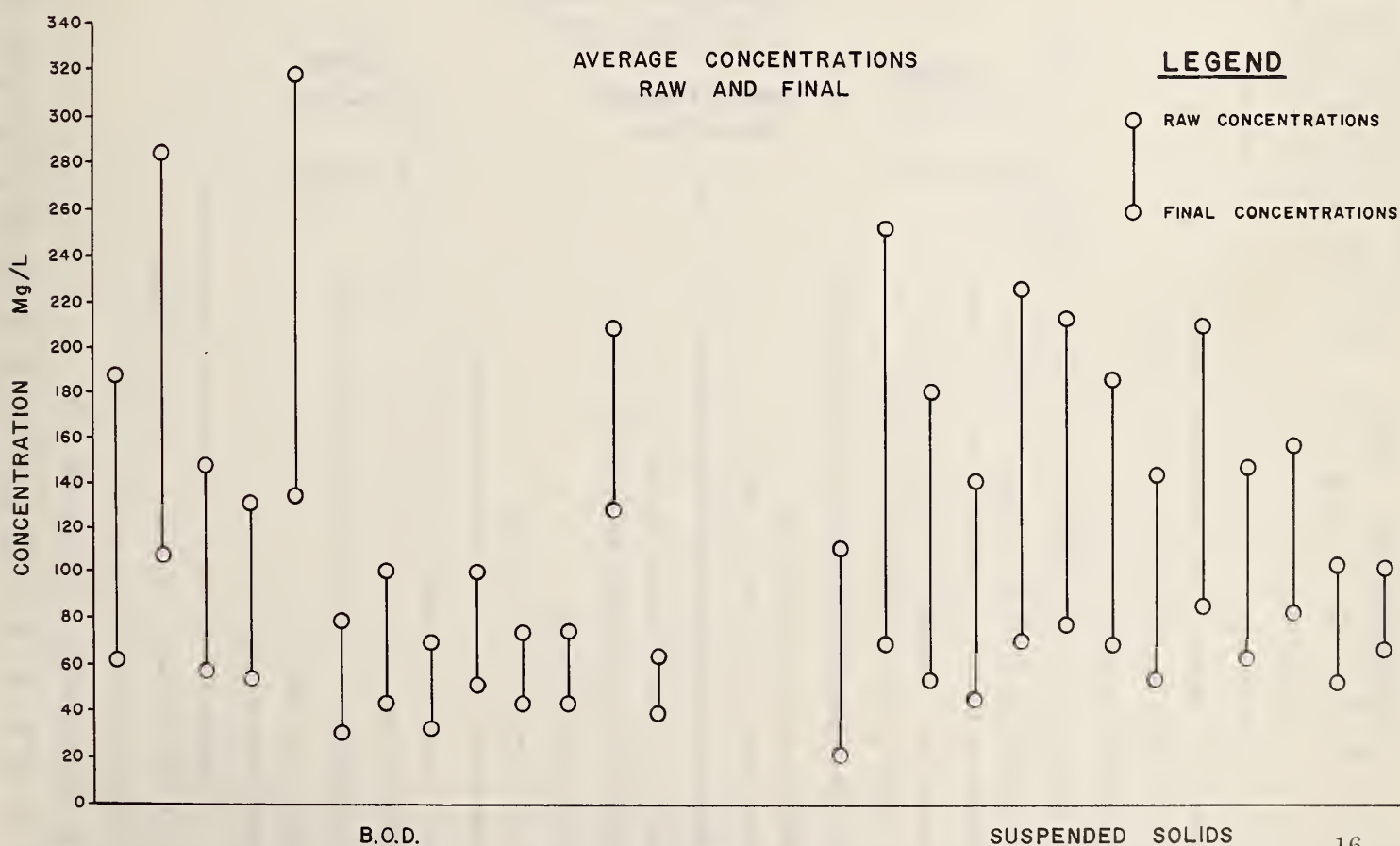
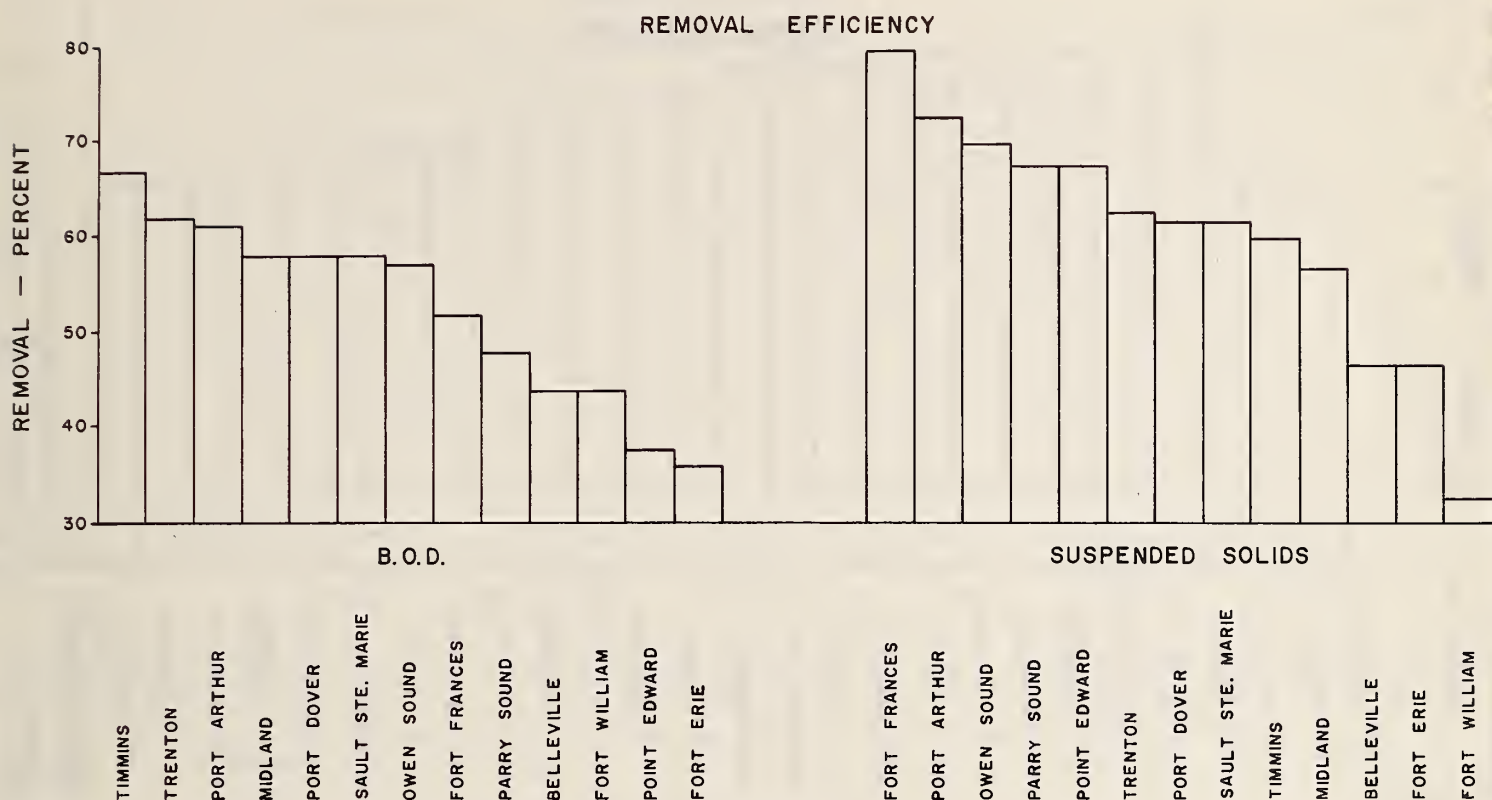


FIGURE N°6
BIOCHEMICAL OXYGEN DEMAND
CONVENTIONAL ACTIVATED SLUDGE PLANTS
1966

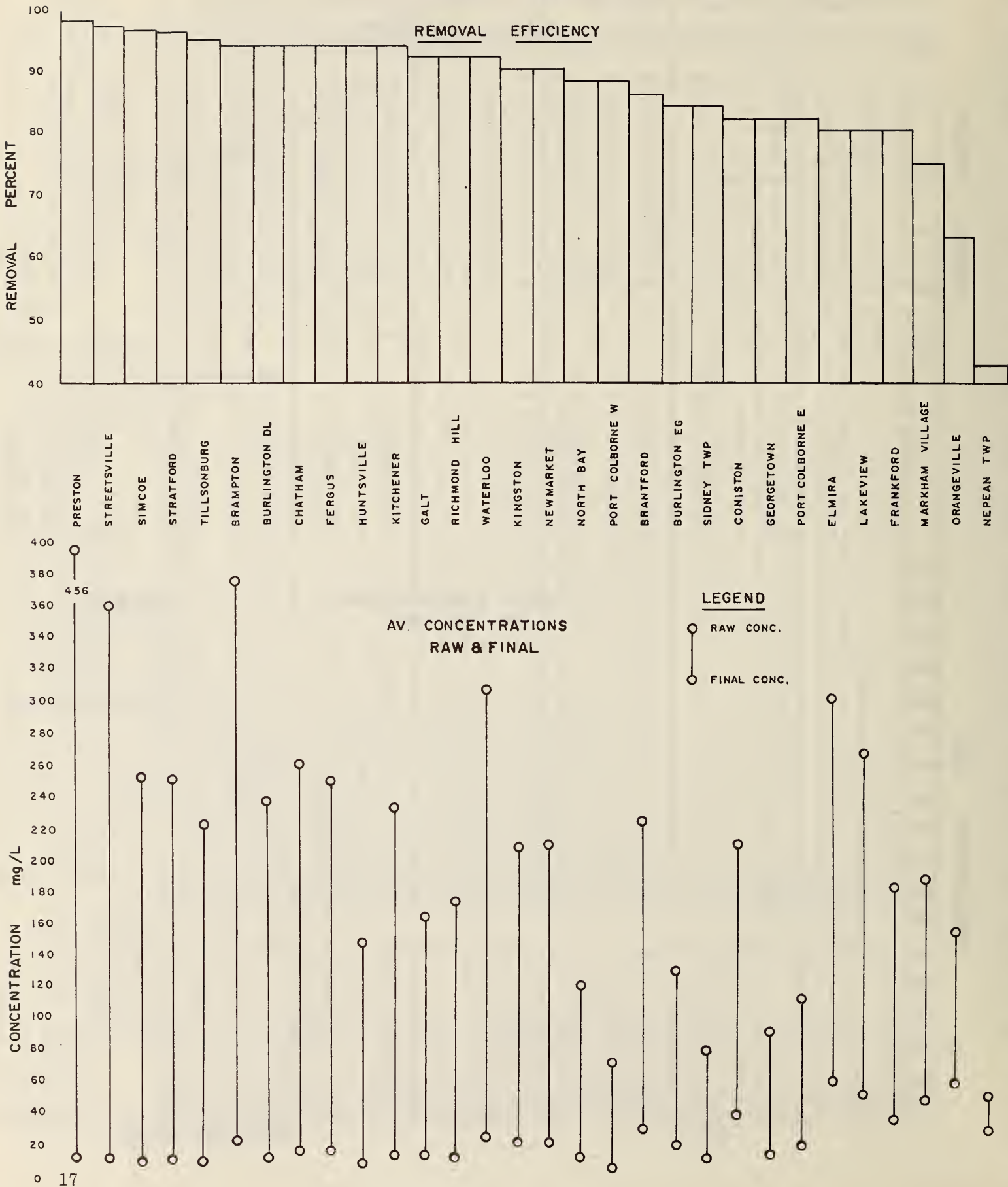


FIGURE No. 7
SUSPENDED SOLIDS
CONVENTIONAL ACTIVATED SLUDGE PLANTS
1966

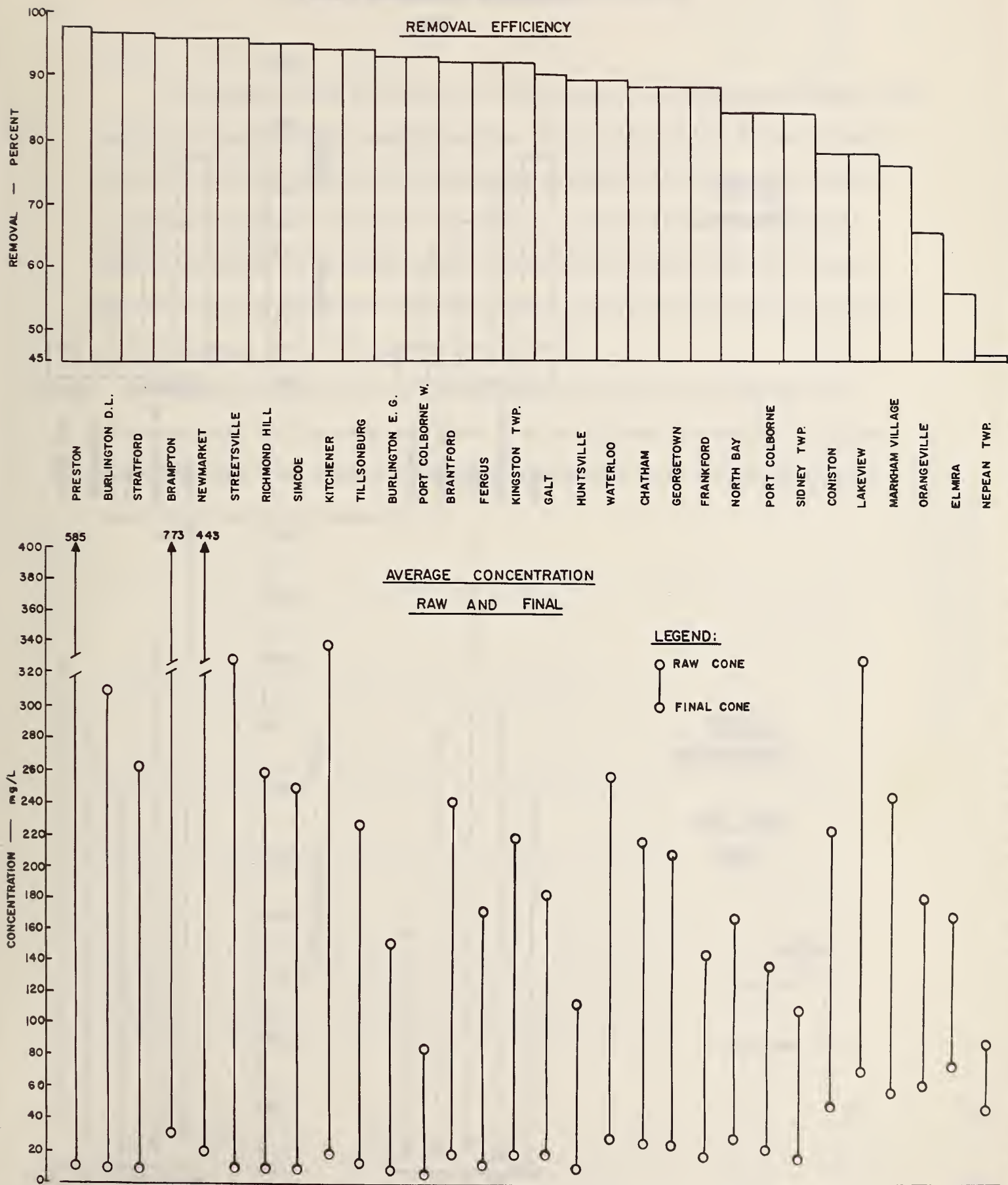
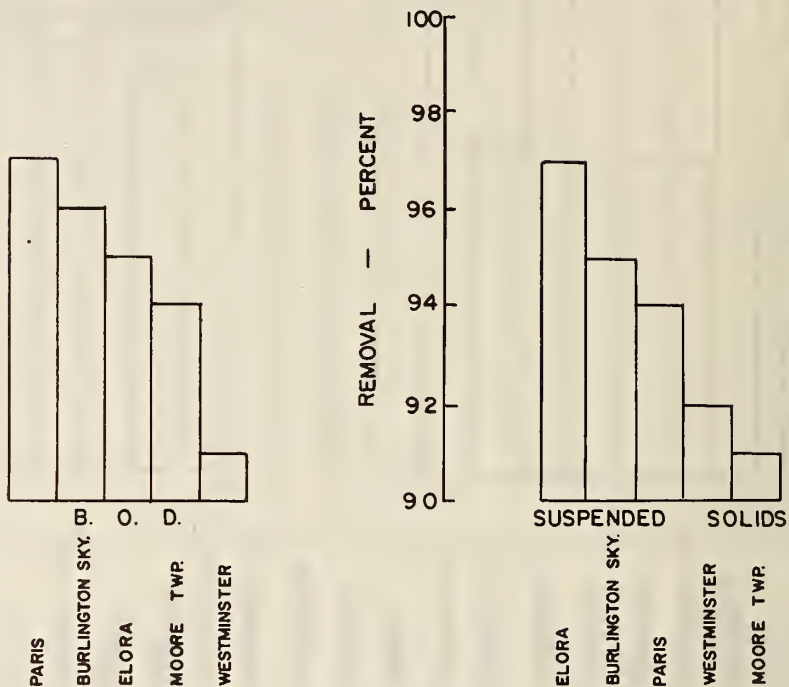


FIGURE No. 8
BIOCHEMICAL OXYGEN DEMAND
AND SUSPENDED SOLIDS
EXTENDED AERATION PLANTS
1966

REMOVAL
EFFICIENCY

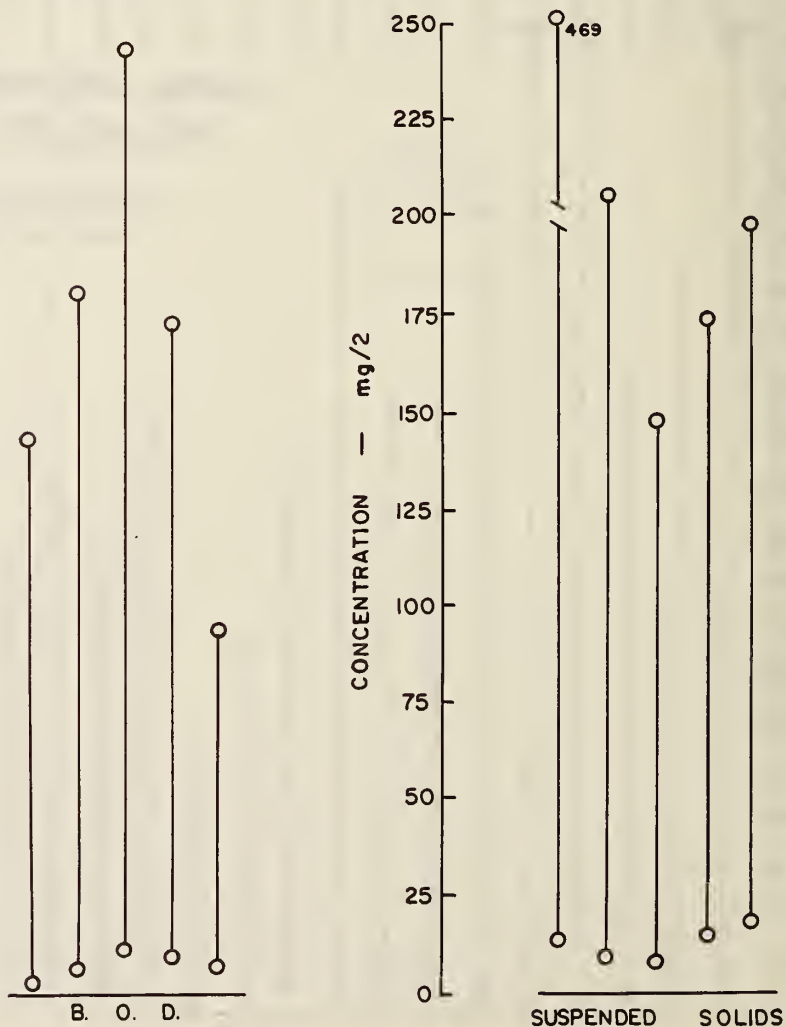


AVERAGE
CONCENTRATIONS

RAW AND
FINAL

LEGEND:

○ RAW CONE
○ FINAL CONE



AERATION TANK PERFORMANCE

The Aeration Tank Performance for each project is summarized in Tables VIII and IX for conventional and extended aeration plants respectively. Figure 9 graphically shows the aeration tank loading expressed as pounds of BOD per 100 pounds of mixed liquor suspended solids for each project. As can be seen from this figure, many of the plants are operating below or in the lower portion of the WPCF recommended range. Brampton and Lakeview, the two plants above the WPCF recommended loading range, were both expanded during 1966.

The air required per pound of BOD removed and the corresponding food to micro-organism ratio is shown in Figure 10 for all diffused air plants. This figure shows that most of the plants are supplying considerably more air than is required according to the WPCF Manual No. 8.

AERATION TANK PERFORMANCE
CONVENTIONAL ACTIVATED SLUDGE PLANTS
1966

TABLE VIII

PROJECT	TYPE	DESIGN FLOW MGD	ACTUAL FLOW MGD	MLSS (MG/L)	PRIM. EFF. BOD (MG/L)	LBS. BOD 100 LBS. MLSS	FT ³ AIR LBS. BOD REM.	KW HRS. LB. BOD REM.	DIFFUSER TYPE	DETENTION	
										DESIGN HRS.	AT MAX. MO. FLOW + 25% RETURN
BRANTFORD BRAMPTON/CHINGWAGOUSY	TRIPLE PASS SINGLE PASS	12.500 2.000	6.823 2.621	2376 958	154 132	14 64	1484 1004	1.035 0.543	SPARJERS COLIFLEX SPARJER	6 10.2	6.52 5.46
BURLINGTON DL	TRIPLE PASS	2.500	1.585	2192	155	14	1419	0.636	DIFFUSERS	6	4.40
BURLINGTON EG	SINGLE PASS	0.750	0.816	1592	119	22	1521	0.667	SPARJERS COLIFLEX	6	2.41
CHATHAM	TRIPLE PASS	4.500	1.925	730	139	45	2656	0.361	TUBE DIFF.	7.15	6.30
CONISTON	MECH. AERA.	0.260	0.173	1403	148	34	-	0.872	A.C. 1	10.6	5.38
ELMIRA	MECH. AERA.	0.680	0.556	4097	286	16	-	0.192	A.C. 4	4.4	2.42
FERGUS	MECH. AERA.	0.600	0.600	2552	130	22	-	0.469	A.C. 3	7.0	4.91
GALT	MECH. AERA.	5.000	5.216	2675	129	18	-	0.854	A.C. 20 PER	8.0	7.02
GEORGETOWN	MECH. AERA.	1.500	0.996	1439	55	15	-	0.925	A.C. 8	6.75	3.84
HUNTSVILLE	MECH. AERA.	0.250	0.267	702	-	-	-	1.730	CHICAGO PUMP 2	7.5	7.1
KINGSTON	SINGLE PASS	0.830	0.512	2597	128	10	3818	0.287	C.P. DISC- FUSSERS	5.85	5.53
KITCHENER	MECH. AERA.	13.500	9.473	2665	188	23	-	1.375	A.C. 56	6.0	2.35
LAKEVIEW	THREE PASS	5.000	7.965	1147	181	82	1038	3.000	SPARJERS	5.4	2.62
MARKHAM VILLAGE	SINGLE PASS	0.334	0.478	-	132	-	2497	1.383	SPARJERS	8.0	2.00
NEPEAN TOWNSHIP	MECH. AERA.	1.500	2.768	1724	34	16	-	-	A.C. 6	5.31	7.42
NEWMARKET	MECH. AERA.	2.000	1.500	1605	118	17	-	-	SINCAR 12	-	3.39
NORTH BAY	SINGLE PASS	4.000	3.798	1452	70	16	3362	2.380	SPARJER	2.14	1.70
ORANGEVILLE	SINGLE PASS	0.750	0.574	1334	105	18	2100	0.800	HOLES IN PIPE	6.0	2.98
PORT COLBORNE E	MECH. AERA.	0.850	0.892	2602	*112	20	-	0.561	A.C. 4	6.7	3.32
PORT COLBORNE W	MECH. AERA.	0.900	0.979	1375	40	22	-	1.370	A.C. 6	5.9	3.43
PRESTON	MECH. AERA.	1.800	0.923	2798	207	11	2250	3.010	A.C. 6	6.65	4.91
RICHMOND HILL	SINGLE PASS	1.600	1.626	1744	96	26	-	1.825	CARBON DIFF.	7.68	6.34
SIDNEY TOWNSHIP	SINGLE PASS	0.120	0.185	1722	36	11	-	0.580	ARAMEC DIFF.	5.7	4.04
SIMCOE PLANT #1	SINGLE PASS	0.600	0.528	2395	158	31	3770	1.185	HOLES IN PIPE	10.1	5.64
SIMCOE PLANT #2	SINGLE PASS	1.400	1.194	2047	216	24	5261	1.110	* SPARJERS	7.2	6.16
STRATFORD	SINGLE PASS	4.000	3.071	2699	79	10	1773	0.432	INKA	-	-
STREETSVILLE	SINGLE PASS	0.800	0.546	2244	200	21	1570	-	OME DIFF.	-	-
TILLSONBURG	SINGLE PASS	0.665	0.731	1899	120	17	2410	-	TUBE DIFF.	-	-
WATERLOO	BIOREACTOR	4.000	3.123	2418	214	19	2016	-	SPARJERS	-	-

TABLE IX

AERATION TANK PERFORMANCE
EXTENDED AERATION PLANTS

1966

PROJECT	TYPE	DESIGN FLOW MGD	ACTUAL FLOW MGD	MLSS (mg/L)	INFLUENT BOD (mg/L)	LBS. BOD 100 LBS. MLSS	FT ³ AIR LBS. BOD REM.	KW HRS. LB. BOD REM.	DIFFUSER TYPE	DETENTION	
										DESIGN HRS.	AT MAX. MO. FLOW + 25% RETURN
BURLINGTON SKY	SINGLE PASS	3.125	2.771	6057	188	2	1657	-	SARAN 1500 TUBES C.P.	31.7	22.92
ELORA	SINGLE PASS	0.083	0.050	5982	241	3	4527	1.362	SPARJERS SPARJERS A.C. TYPE 50 DIFFUSERS	25.0	23.32
MOORE TOWNSHIP PARIS	SINGLE PASS TRIPLE PASS	0.320 0.500	0.085 0.466	4877 -	4170 -	2 -	11301 -	- -		24.0 -	51.19 -
WESTMINSTER	SINGLE PASS	0.250	0.180	5916	91	2	4759	-		24.2	20.72

FIGURE N°9

AERATION TANK PERFORMANCE

1966
LB. BOD/100 LB. MLSS

V S

MIXED LIQUOR SUSPENDED SOLIDS

LOG GROWTH

WPCF MANUAL
NO 8
OPERATING RANGE
FOR CONVENTIONAL
AS PLANTS

POUNDS OF BOD PER 100 POUNDS MIXED LIQUOR SUSPENDED SOLIDS

62
60
55
50
45
40
35
30
25
20
15
10
5
0

NON
DATUM

CHATHAM
BRAMPTON
LAKEVIEW

ORANGEVILLE
PORT COLBORNE W.
GEORGETOWN
N. BAY
BURLINGTON E.G.
NEWMARKET
SIDNEY TWP.
NEPEAN TWP.
RICHMOND HILL

TILLSONBURG

SIMCOE PLANT NO. 2

STREETSVILLE
BURLINGTON DL

BRANTFORD
SIMCOE PLANT NO. 1
WATERLOO

FERRIS
KINGSTON
STRAITFORD
PORT COLBORNE E.
KITCHENER
GALT

PRESTON

ELMIRA

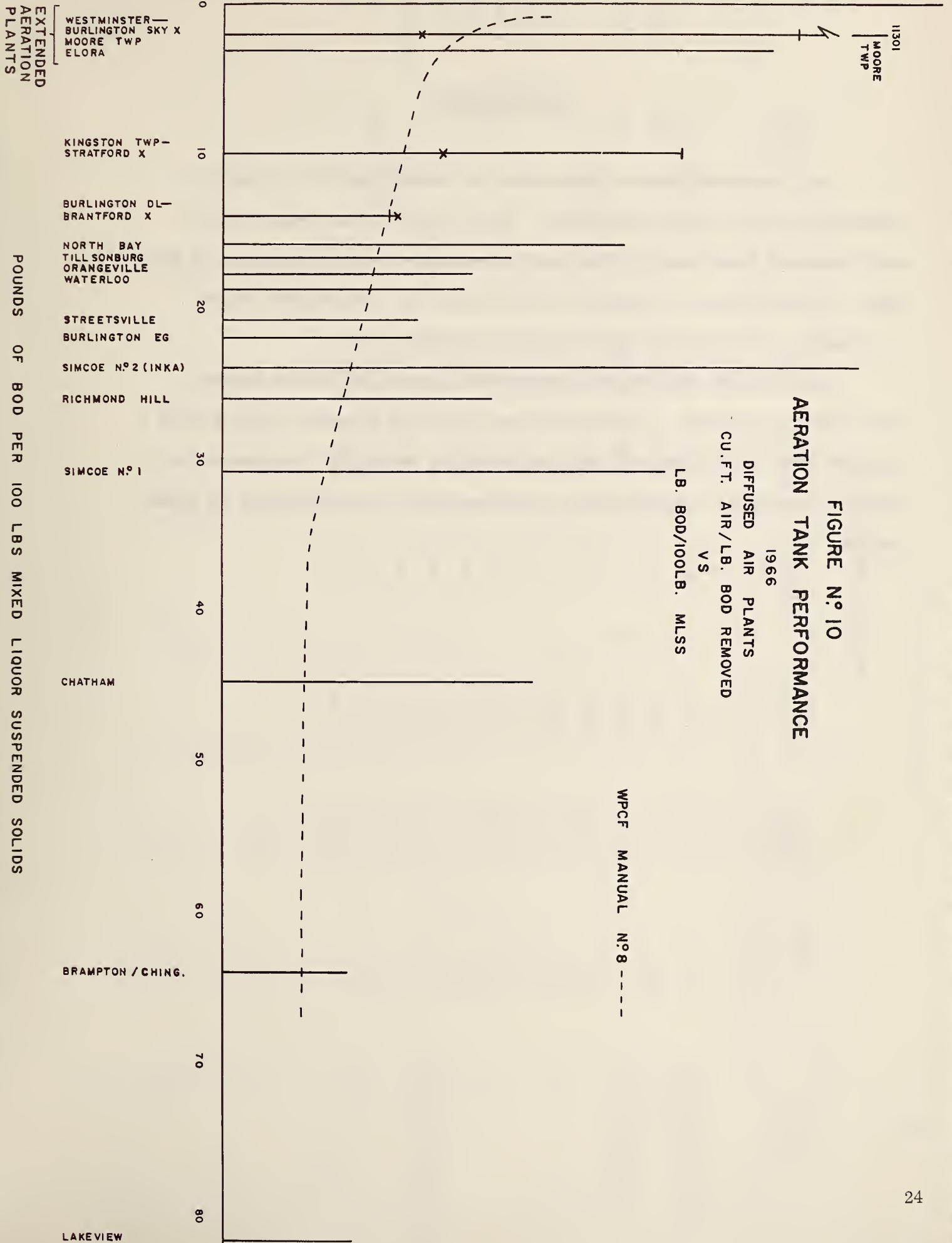
MOORE TWP

WESTMINSTER
ELORA
BURLINGTON
SKYWAY

EXTENDED
AERATION
PLANTS

MIXED LIQUOR SUSPENDED SOLIDS — MILLIGRAM PER LITRE

CUBIC FEET OF AIR PER POUND OF BOD REMOVED



CHLORINATION

The chlorination data are summarized in Tables X and XI for primary and secondary treatment plants respectively. The average chlorine dosage for primary treatment plants was 6.30 mg/l and for secondary treatment plants, 4.46 mg/l. These average dosages are within the WPCF Manual No. 8 chlorination ranges of 5-10 mg/l for primary plants and 2-8 mg/l for secondary plants.

Point Edward, Port Dover, Chatham and Coniston had average dosages much higher than normal. A possible reason for the high dosages at Point Edward and Port Dover is the extremely long contact period, averaging 74 minutes and 66 minutes respectively. Chatham had a high dosage due to pre-chlorination for odour control.

TABLE X

SUMMARY CHLORINATION DATA 1966

PROJECT	DESIGN RETENTION (MIN)	AV. RETN. (MIN)	TOTAL FLOW MG	TOTAL CHLORINE LBS.	MAX. MONTH C12 DOSAGE (mg/L)	MIN. MONTH C12 DOSAGE (mg/L)	AVG. MONTH C12 DOSAGE (mg/L)	MONTHS OF CHLORINATION	COMMENTS
PRIMARY PLANTS									
BELLEVILLE	31	17.0	1993,830	31323	3.91	2.81	3.36	6	
FORT ERIE	13.4 + OUTFALL	14.7	603,50	11296	5.40	0.96	4.01	6	EXCLUDES INFLUENT CHLORINATION
FORT FRANCES	20.6	19.7	762,339	11635	4.08	2.36	3.31	5½	
FORT WILLIAM	3.3	7.2	995,520	33303	6.20	0.92	3.34	12	IN EFFLUENT CHANNEL
MIDLAND	18.7 + OUTFALL	23.2 +	367,780	13540	10.38	6.32	8.21	5½	
OWEN SOUND	11.2	10.5	1166,200	21218	5.68	3.58	3.99	6½	
PARRY SOUND			231,646	13991	11.11	4.18	7.26	10	
POINT EDWARD	27.0	74.0	75,918	9167	16.43	10.05	12.08	12	
FORT ARTHUR	20.0	16.0	1825,520	31072	4.83	2.77	3.78	5½	
FORT DOVER	11.0	66.0	127,706	8383	21.67	9.40	14.91	6	CHLORINATOR O/S 30 DAYS
SAULT STE. MARIE	1.5 + OUTFALL	1.6	2668,910	59495	6.47	2.64	5.12	5½	
TIMMINS	19.0 + OUTFALL	18.4	1130,981	28710	6.53	3.83	5.32	5½	
TRENTON	37	57.8	233,760	16620	18.02	3.09	7.11	12	

TABLE XI

PROJECT	DESIGN RETENTION (MIN)	AV. RETN. (MIN)	TOTAL FLOW MG	TOTAL CHLORINE LBS.	MAX. MONTH CL ₂ DOSAGE (MG/L)	MIN. MONTH CL ₂ DOSAGE (MG/L)	AUG. MONTH CL ₂ DOSAGE (MG/L)	MONTHS OF CHLORINATION	COMMENTS
SECONDARY PLANTS									
BRANTFORD	5+OUTFALL	9.2	2490,546	52516	2.59	1.65	2.15	12	
BRAMPTON/ CHINGUACOUSY	15.0	11.4	956,599	49067	7.52	3.49	5.13	12	
BURLINGTON D.L.			578,418	17093	3.41	2.38	2.96	12	
BURLINGTON E.G.	10+OUTFALL	9.2	297,759	6585	4.05	1.23	2.21	12	
BURLINGTON SKYWAY			1011,463	14815	4.08	2.62	3.57	5	
CHATHAM	22	48.3	717,082	44213	11.82	5.28	8.29	7	
CONISTON	10.0	15.0	63,139	2730	11.80	9.01	10.18	6	
ELMIRA	22.5	27.5	202,882	6681	7.30	1.85	3.29	12	
ELORA	37.7	62.6	18,142	836	7.72	2.11	4.61	12	
FERGUS	15.0	15.0	219,048	9823	6.62	2.90	4.48	12	
GALT	13.2	12.6	1903,925	63990	3.96	3.06	3.36	12	
GEORGETOWN	26.0	39.2	363,471	10450	3.91	2.16	2.88	12	
HUNTSVILLE	35.0	33.7	97,467	1828	5.87	2.10	3.98	6	
KINGSTON TWP.	18.0	29.2	186,699	3973	5.42	3.01	3.73	7	
KITCHENER	15.0	21.4	3457,800	149717	8.53	2.93	4.33	12	
LAKEVIEW	50.0	31.4	2907,316	195565	8.10	4.34	6.73	12	
MARKHAM VILLAGE	52.0	36.4	174,330	5904	4.34	2.62	3.39	12	
MOORE TWP.			31,102	1883	10.08	4.15	6.05	12	DETENTION IN OUTFALL
NEPEAN TWP.	17.0	9.2	1010,462	10789	3.14	2.15	2.70	5½	
NEWMARKET	39.7	52.9	547,447	10980	5.58	3.59	4.61	5	
NORTH BAY	25.0	26.3	1386,417		DATA NOT AVAILABLE			5	

SECONDARY CHLORINATION DATA 1956

TABLE XI (CONT'D)

PROJECT	DESIGN RETENTION (MIN)	AV. RETN. (MIN)	TOTAL FLOW MG	TOTAL CHLORINE LBS.	MAX. MONTH CL ₂ DOSAGE (MG/L)	MIN. MONTH CL ₂ DOSAGE (MG/L)	AVG. MONTH CL ₂ DOSAGE (MG/L)	MONTHS OF CHLORINATION	COMMENTS
SECONDARY PLANTS									
ORANGEVILLE	29.6	38.7	209,502	12867	8.43	4.71	6.14	12	
PARIS			169,979						NO CHLORINATION FACILITIES
PORT COLBORNE E.			325,519						NO CHLORINATION FACILITIES
PORT COLBORNE W.	16.0	14.7	357,337	7839	4.26	1.50	2.19	12	
PRESTON	15.0	29.2	336,947	18323	6.82	4.06	5.44	12	
RICHMOND HILL	11.3	11.1	593,445	33062	8.36	3.71	5.57	12	
SIDNEY TWP.	20.0	13.0	67,420	2537	6.18	3.00	3.76	12	
SINCOE (COMBINED)	16.4 13.0	17.1 14.7	628,389	9897	6.03	4.21	4.97	4	
STRATFORD			1120,840						NO CHLORINATION FACILITIES
STREETSVILLE	20.0	29.3	199,465	6143	5.27	1.93	3.60	11	NO CL ₂ WHEN ICE COVER
TILLSONBURG	30.2	27.5	266,673	4577	4.78	2.78	4.19	5½	
WATERLOO			1139,852	59554	7.39	4.31	5.40	12	CHLORINATION IN OUTFALL
WESTMINSTER	22.7	31.5	65,665	1648	6.35	4.61	5.51	5½	
FRANKFORD			55,945	1800	4.07	2.32	3.11	12	SEE BELOW

* TRICKLING FILTER - FLOWS ARE ESTIMATED ON 134 DAYS DATA WITH RECIRCULATION THROUGH METER

DIGESTER PERFORMANCE

The digester performance is summarized in Tables XII and XIII for primary and secondary plants respectively. Figure No. 11 is a bar graph displaying volume and solids reductions through digestion at individual projects.

Of the 37 plants utilizing digestion systems the limited data available indicates that the actual overall loading exceeded the WPCF Manual No. 8 recommendations at only two projects, Owen Sound and Lakeview. However, the actual primary digester loading was in excess of these recommendations at 6 projects, Owen Sound, Lakeview, Brampton, Brantford, Kitchener, and Richmond Hill.

The volume reductions due to digestion are not significant for Elmira, Fergus and Galt since the digesters were emptied for repairs during 1966. The high volume reduction at Brampton is possibly due to the disposal of quantities of supernatant of poor quality.

TABLE XII

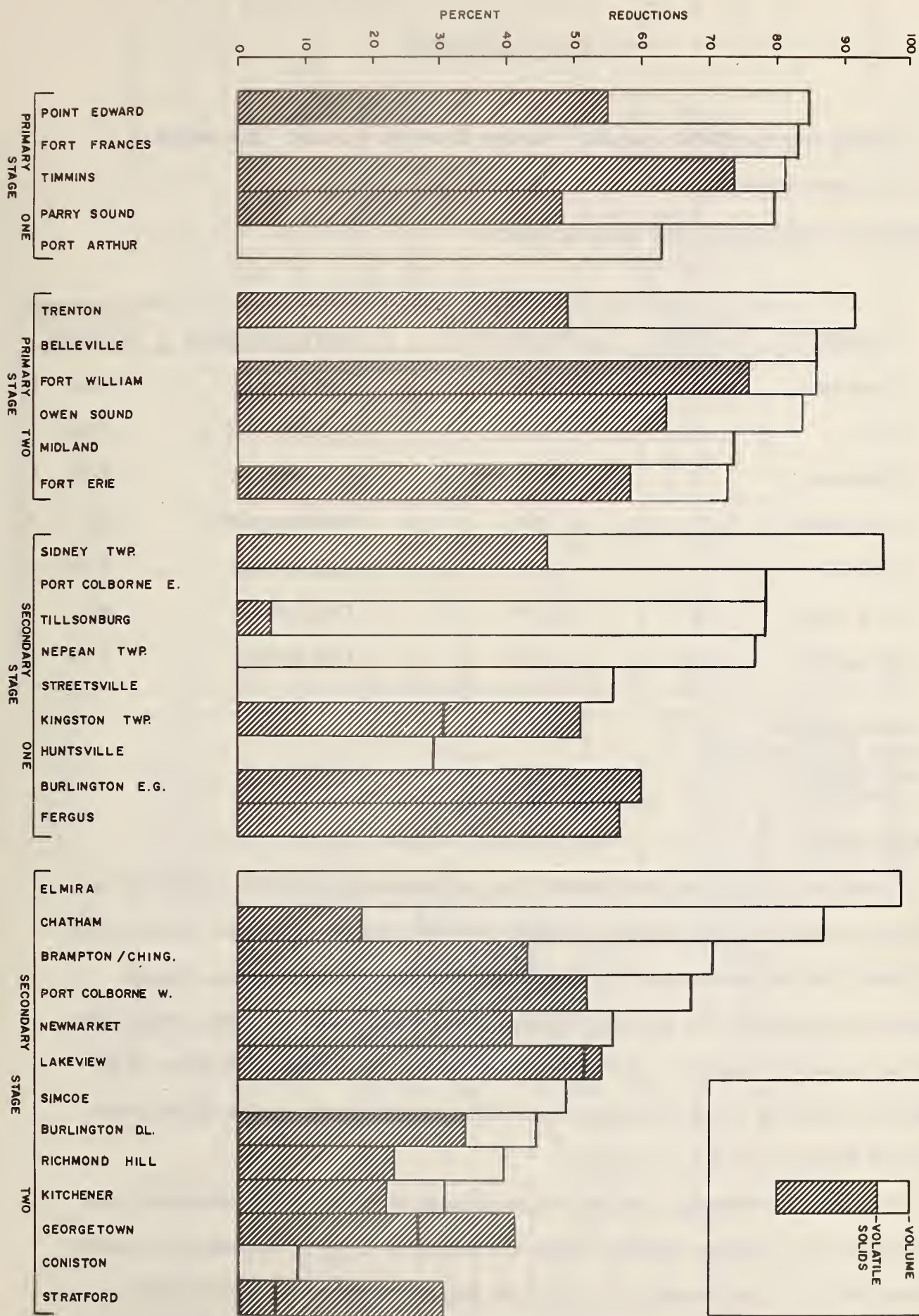
DIGESTER PERFORMANCE 1966

PROJECT	DESIGN LOADING			ACTUAL LOADING			SLUDGE				REDUCTION		GAS PROD. VS RED.		
	PRIMARY FT. ³ /CAP. LB/FT MO	3 TOTAL LB/FT MO.	3 FT. CAP. LB/FT MO.	3 PRIMARY FT. /CAP. LB/FT. MO.	3 TOTAL LB/FT. MO.	3 FT. /CAP. LB/FT. MO.	FEED TS% VS%	DIGESTED TS% VS%	VS %	VOL %					
FORT FRANCES PARRY SOUND POINT EDWARD PORT ARTHUR TIMMINS	2.6 2.75 2.66 1.25 2.66	.85 1.13 2.00 1.35	2.6 2.75 2.66 1.25 2.66	PRIMARY TREATMENT - SINGLE STAGE DIGESTION						7.23 3.21 5.62 2.96	51 74 43 78	2.04 13.85 6.02 6.81	57 35 56 48	84 80 85 63 82	5.7
PRIMARY TREATMENT - TWO-STAGE DIGESTION															
BELLEVILLE FORT ERIE FORT WILLIAM MIDLAND OWEN SOUND TRENTON	1.32 1.30 .74 1.25 1.25 1.13	2.65 2.56 1.50 2.47 2.48 2.25	1.91 1.37 1.50 1.88	1.2 1.6 .74 1.60 1.70 .98	2.2 1.7 .9 7.6 2.2	2.4 3.2 1.5 3.1 3.4 2.0	1.10 .96 .45 3.80 1.10	2.36 7.01 2.53 9.84 2.56	67 70 50 67	10.20 10.56 14.36 8.97 8.83	46 36 30 51	58 76 74 63 49	86 73 86 74 92	14.0 13.0 28.0 17.0	

TABLE XIII

PROJECT	DESIGN LOADING			ACTUAL LOADING			SLUDGE			REDUCTION		GAS PRODN. 3 FT ³ /LB VS RED
	FT ³ CAP, LB/FT ³ MO.	FT ³ CAP.	TOTAL LB/FT ³ MO.	FT ³ CAP, LB/FT ³ MO.	FT ³ CAP.	TOTAL LB/FT ³ MO.	FEED VS% TS%	DIGESTED VS% TS%	VS %	VOL %		
ACTIVATED SLUDGE - SINGLE STAGE DIGESTION												
BURLINGTON E.G.		4.20	1.50			.70	4.75	73	3.36	60		
FERGUS		4.80	1.40		5.1	.62	4.09	73	3.19	57		
HUNTSVILLE		5.00	1.20		4.5	.57	5.52	47	4.83	0	29	
KINGSTON TWP.		5.45			4.4	.57	3.78	71	5.82	51	31	
MARKHAM VILLAGE		8.80	0.67		4.5		.28		.14			
NEPEAN TWP.		4.00	2.02		1.3	.40	2.12	77			77	
PORT COLBORNE E.		5.28	1.59		.82	.88	1.44	72	3.62	46	96	
SIDNEY TWP.		4.00	1.50		7.2	.39					56	
STREETSVILLE		4.50	1.50		5.9		3.59	71	2.15	5	78	
TILLSONBURG		5.14	1.32									
ACTIVATED SLUDGE - TWO STAGE DIGESTION												
BRAMPTON	1.67	3.33	2.25	1.1	5.0	2.2	2.94	75	2.22	43	71	
BRANTFORD	1.50	4.50		1.7	5.0	5.0	5.30	66	4.26	29	11	
BURLINGTON D.L.	1.67	2.43			2.0	1.4	3.85	62	4.20	34	45	16
CHATHAM	1.91	3.73		2.7	5.4	5.4	5.85	51	8.34	18	87	37
CONISTON	2.53	2.74		2.5	2.8	1.0	4.17		6.36		9	
ELMIRA	3.85	6.16		3.8	7.6	1.1	2.81	58			99*	
GALT	.89	3.42		.93	3.3	.99	4.34	63				
GEORGETOWN	5.20	6.60		6.7	8.5	1.1	10.08	53	7.14	42	27	
KITCHENER	1.44	5.44		1.6	6.0	1.6	5.88	62	5.31	22	31	
LAKEVIEW	1.64	3.28		.88	1.8	4.8	5.55	64	4.83	54	52	12
NEWMARKET				3.1	2.9	1.4	4.89	64	5.48	41	56	11
NORTH BAY	1.40	2.90		3.1	2.6	1.3	3.21	68	5.05	38	28	
PORT COLBORNE W	2.34	3.83	2.18	1.1	6.4	.68	4.04	74	3.98	52	67	17
RICHMOND HILL	0.85	3.28		0.7	2.7	2.4	4.15	69	3.08	23	40	
SIMCOE	4.0	5.60	1.43								49	
STRATFORD	2.25	3.33		3.0	1.9	1.3	6.00	71	4.19	31	6	20

FIGURE NO. 11
DIGESTER OPERATION
% REDUCTION OF VOL. SOLIDS AND VOLUME
1966



VACUUM FILTRATION

During 1966 the OWRC operated 9 vacuum filters at 7 plants. The details of each of the installations is given in the table below.

TABLE XIV - VACUUM FILTER DESIGN DATA

PROJECT	NO. OF FILTERS	TOTAL FILTER AREA (SQ. FT.)	FILTER MEDIUM	TYPE OF SLUDGE	
Brantford	2	700	Coil Springs	P+A:	D
Galt	1	380	Synthetic Cloth	P+A:	D
Kitchener	1	500	Coil Springs	P+A:	D
Port Dover	1	200	Synthetic Cloth	P:	R
Preston	1	250	Coil Springs	P+A:	R
S. S. Marie	2	400	Coil Springs	P:	R
Waterloo	1	300	Coil Springs	P+A:	R

P - Primary Sludge
A - Waste Activated Sludge
R - Raw Sludge
D - Digested Sludge

PERFORMANCE

Table No. XV summarizes vacuum filter performance giving the yearly average and maximum and minimum monthly averages for each project. The filter yields for the four plants filtering raw sludge, Port Dover and Sault Ste. Marie filtering primary sludge only and Preston and Waterloo filtering primary and waste activated sludge, fall within the expected range given in the WPCF Manual No. 8. However, all three of the installations filtering digested primary and waste activated sludge exhibit yields below the WPCF design yield of 4 to 5 psf/hr.

The average chemical dosages as a percentage of the dry solids conditioned and the maximum and minimum monthly values are compared to WPCF Manual No. 8 values in Figure No. 13. The average ferric chloride dosages exceeded the WPCF typical values at all but two installations, Sault Ste. Marie and Brantford. The average calcium

TABLE NO. XV

VACUUM FILTRATION PERFORMANCE

1966

MONTHLY DATA

PROJECT	HRS. FILT		% SOLIDS FEED		TON SOLIDS		TONS CAO		% CAO		TONS FEED ₃		% FEED ₃		% SOL CAKE		% SS FILTRT		YIELD PSF PER HOUR	
	MAX. MIN.	AVG.	MAX. MIN.	AVG.	MAX. MIN.	AVG.	MAX. MIN.	AVG.	MAX. MIN.	AVG.	MAX. MIN.	AVG.	MAX. MIN.	AVG.	MAX. MIN.	AVG.	MAX. MIN.	AVG.	MAX. MIN.	AVG.
BRANTFORD P & A: D	355.8 110.4	231.3	4.64 3.96	4.26	228.0 134.5	183.8	46.3 10.7	31.7	29.6 13.2	19.5	7.0 1.2	4.1	3.3 1.4	2.5	20.6 16.5	18.0	1.50 0.67	1.09	2.70 1.86	2.28
GALT P & A: D	207.5 37.5	108.6	5.40 3.70	4.70	141.8 27.4	56.9	16.2 3.1	7.5	21.9 10.6	14.4	5.4 1.2	3.0	7.3 3.8	5.3	25.9 22.3	24.5	0.18 0.04	0.10	4.01 1.59	2.88
KITCHENER P & A: D	423.3 282.9	357.7	7.00 4.69	5.88	438.6 221.0	306.2	60.8 43.4	53.8	24.9 13.1	17.5	17.6 10.9	13.9	6.6 3.8	4.5	22.5 15.9	19.5	2.10 0.7	1.5	4.50 2.59	3.39
AVERAGE P & A: D				4.94						17.1				4.1		20.6		0.9		2.85
WATERLOO P & A: R	264.5 41.5	116.5	7.20 4.05	5.37	184.2 17.9	78.7	15.8 2.5	7.0	15.2 7.9	10.5	4.3 0.8	2.2	4.4 2.3	3.3	23.8 15.5	19.0	1.3 0.5	0.8	5.70 3.30	4.46
PRESTON P & A: R	116.8 52.5	96.4	8.80 5.10	6.30	77.6 54.9	67.5	10.8 1.8	7.7	14.7 3.0	11.4	3.4 0.8	2.6	4.9 1.4	3.8	28.0 19.0	22.2			8.40 4.90	5.80
AVERAGE P & A: R PLANTS				5.83						11.0				3.5		20.6		0.8		5.13
PORT DOVER P & R	17.0 4.0	10.4	7.10 5.10	5.79	11.2 1.9	5.8	1.4 0.2	0.7	16.6 8.5	13.0	0.8 0.1	0.3	14.1 3.5	5.4	30.0 12.5	22.3			6.56 4.70	5.36
SAULT STE. MARIE P & R	95.0 66.0	81.0	8.10 5.60	6.57	200.5 121.2	161.1	7.4 4.9	6.1	4.5 3.4	3.8	1.4 0.7	1.0	0.8 0.5	0.6	27.5 24.8	26.2			11.80 8.75	10.01
AVERAGE				6.18						8.4				3.0		24.2				7.68

FIGURE No. 12
VACUUM FILTRATION YIELD
1966

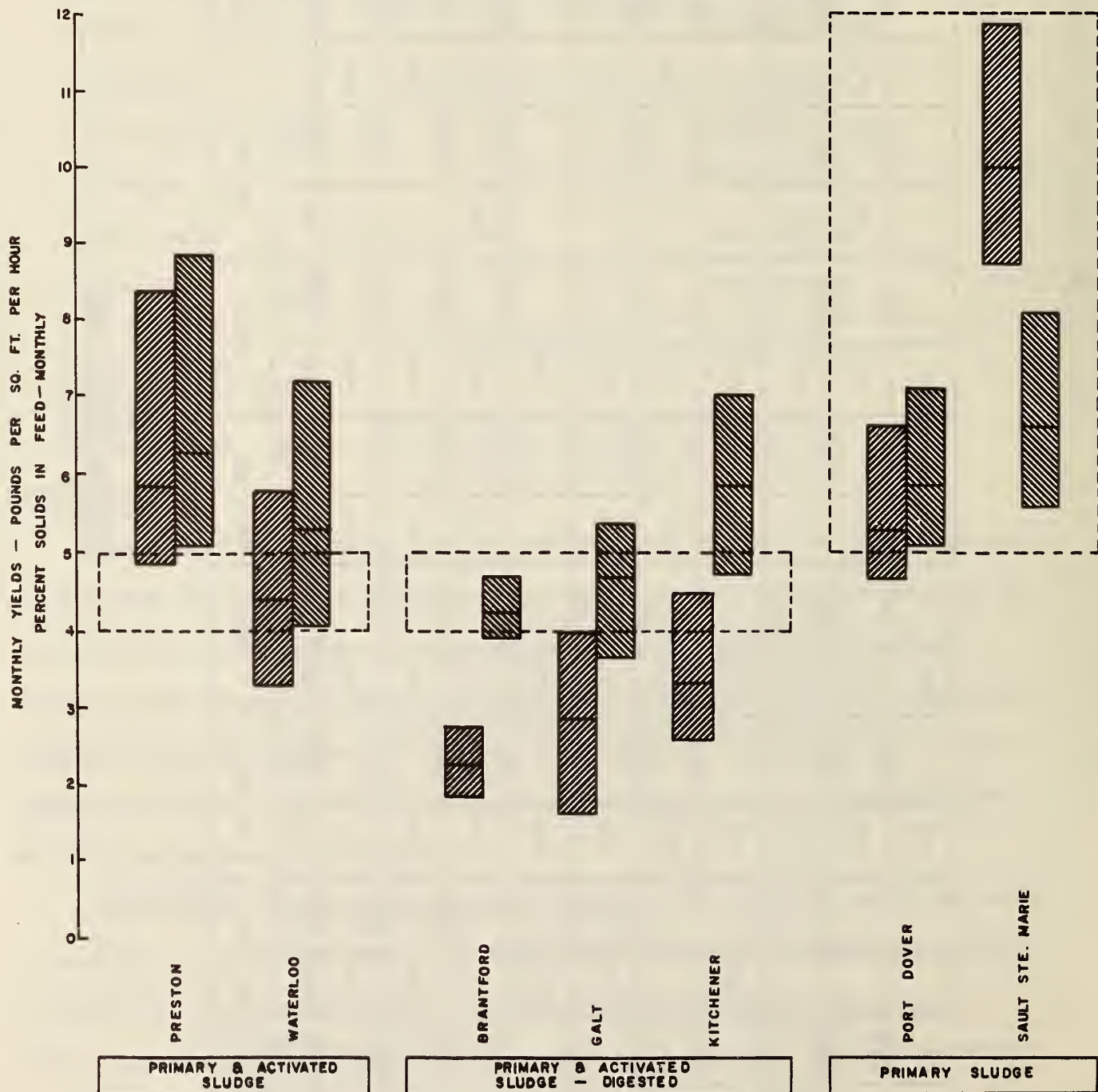
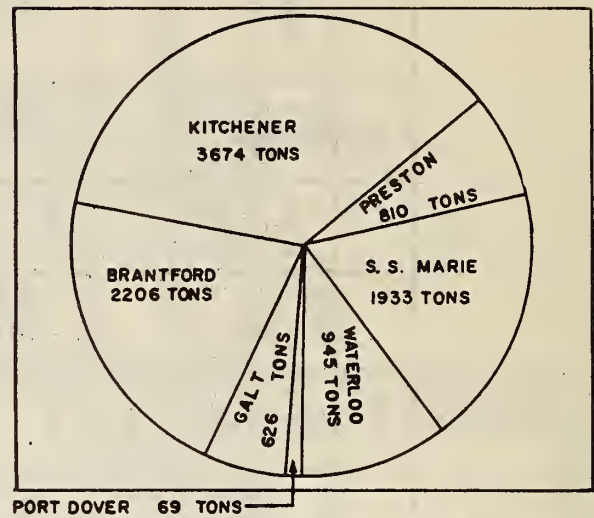
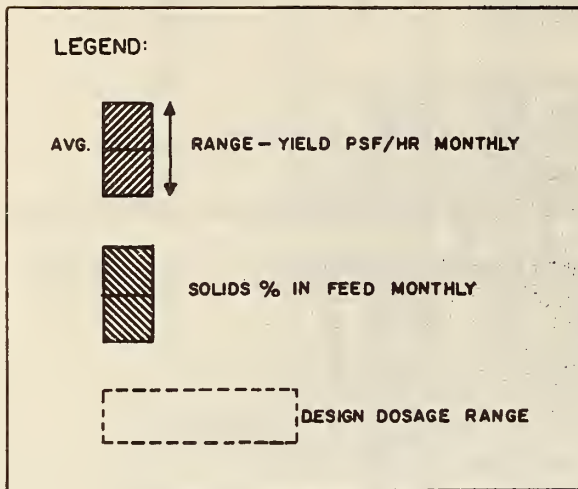
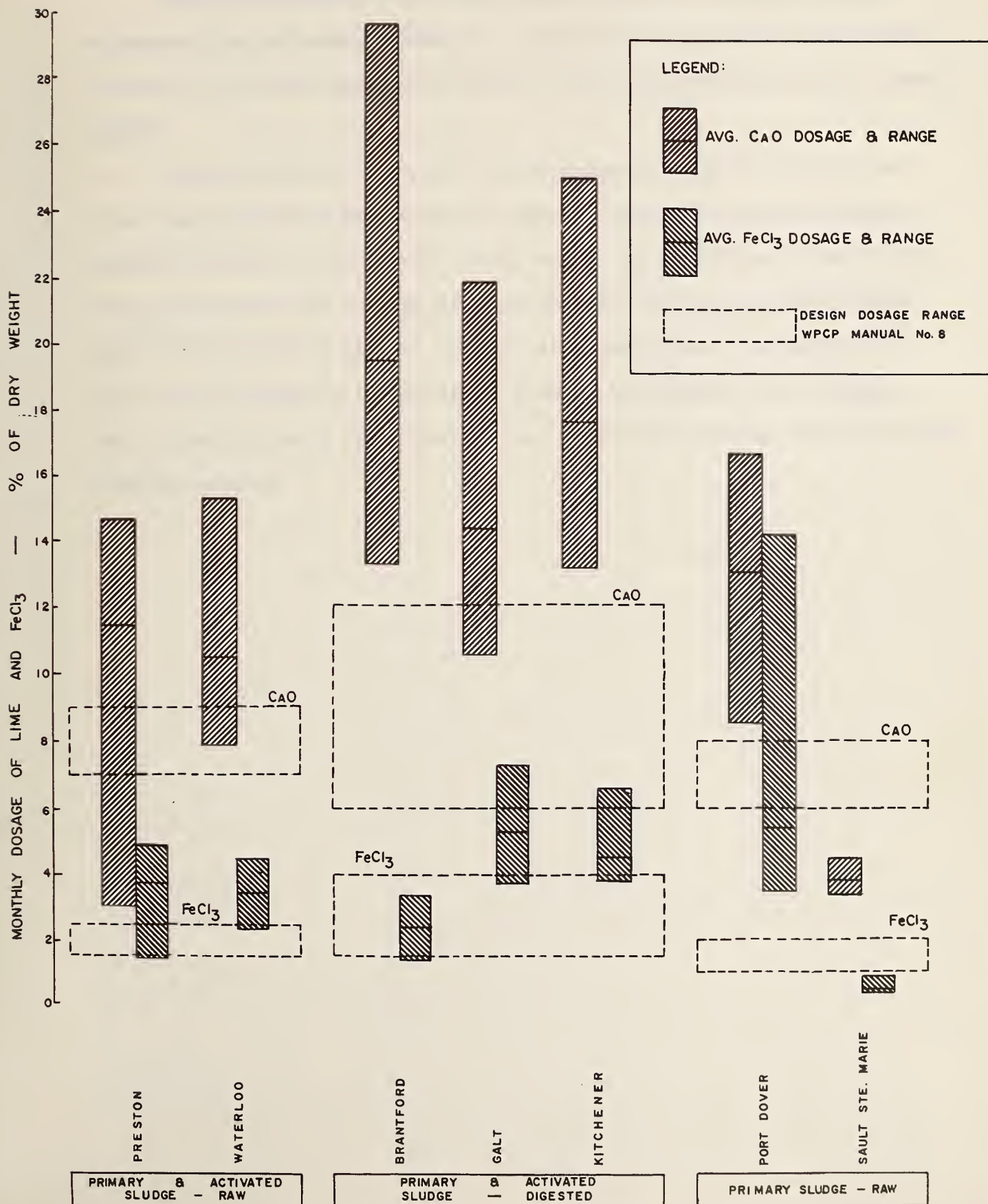
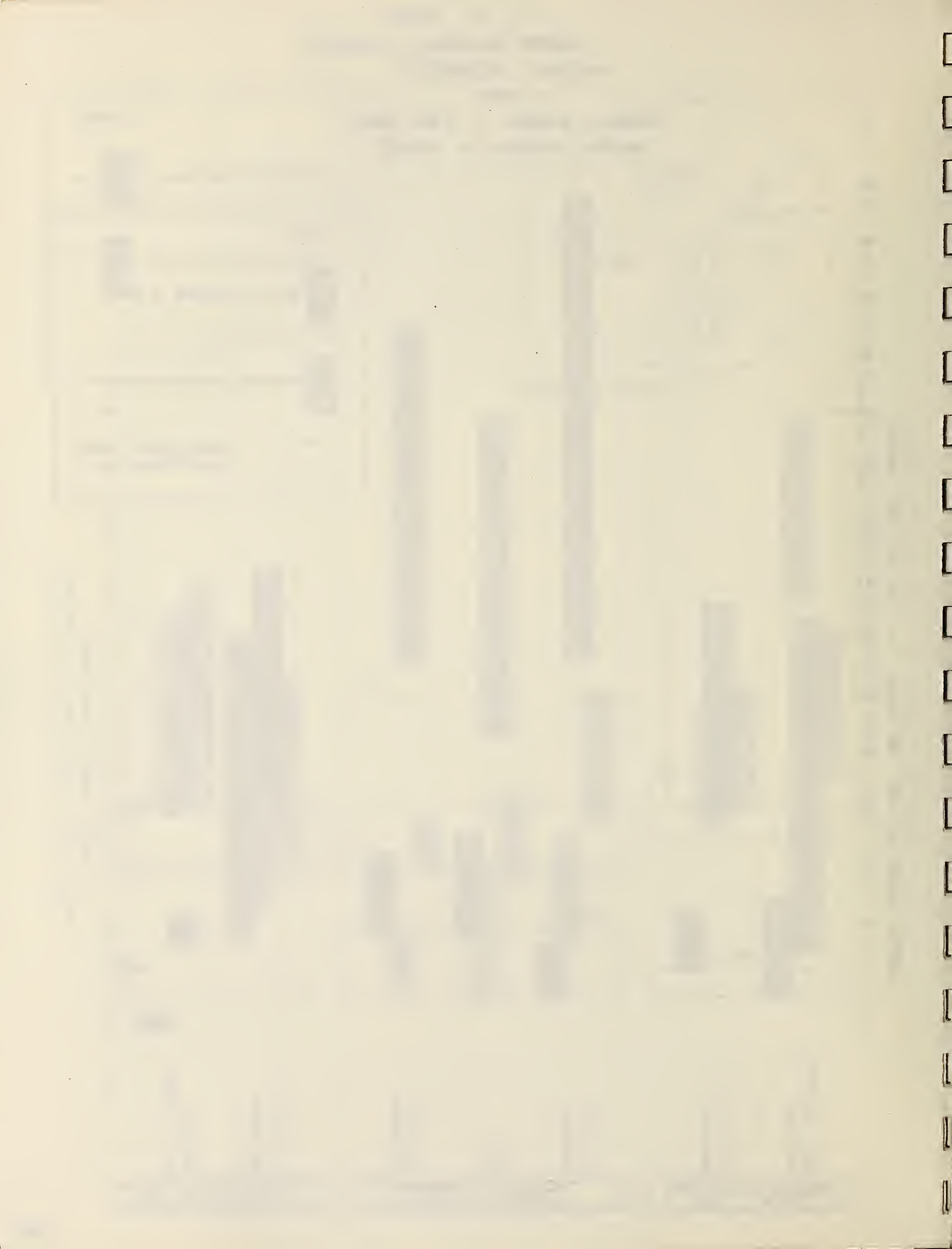


FIGURE No. 13
VACUUM FILTRATION

1966

CHEMICAL DOSAGE — % DRY WEIGHT
MONTHLY AVERAGES & RANGES





oxide dosages exceeded these values at all installations with the exception of Sault Ste. Marie.

During 1966 polyelectrolytes were used in field trials for about one month at Brantford and two months at Waterloo. The data from these trials is not included in Table No. XV, but is included in Table No. XVI, summarizing vacuum filter costs.

COSTS

The cost of labour, electricity and maintenance are estimated figures, but should approximate the actual costs. The average cost of vacuum filter operation, excluding disposal, is \$15.38 per ton of dry solids. The installations having the highest and lowest unit costs are Port Dover and Sault Ste. Marie respectively, both of which filter raw primary sludge. The high cost of vacuum filter operation in Port Dover can be attributed to the high labour costs due to a disproportionately high ratio of clean-up time to actual operating time and to the greater unit cost of chemicals in small quantities.

VACUUM FILTRATION

1966

TABLE XVI

PROJECT	LABOUR	ELECT.	FECt3	LIME	MAINT.	TOTAL	TONS/YR.	DISPOSAL
BRANTFORD *	13,696.65	3,088.64	5,828.09	9,500.85	2,797.00	36,713.61	2206	6,500.00
GALT	3,470.28	638.24	3,942.55	2,131.81	507.15	10,390.03	626	3,192.06
KITCHENER	12,465.99	3,747.73	19,674.57	14,889.13	1,217.26	51,994.68	3674	11,807.68
PORT DOVER	691.20	70.39	623.92	223.94	304.80	1,914.25	69	NIL
PRESTON	3,277.07	841.68	3,659.43	2,256.35	269.34	10,303.87	810	4,376.70
S.S. MARIE	5,630.87	1,993.01	1,755.68	1,831.81	773.21	11,924.58	1933	11,935.60
WATERLOO *	4,059.79	944.59	2,314.47	1,564.11	997.30	12,677.43	945	4,286.83

* POLYELECTROLYTE USED IN LIEU OF LIME AND FERRIC CHLORIDE

POLYELECTROLYTE COST INCLUDED IN TOTAL

COST PER DRY TON FILTERED

PROJECT	LABOUR	ELECT.	FECt3	LIME	MAINT.	TOTAL	DISPOSAL
BRANTFORD	6.24	1.40	2.93	4.37	1.27	16.75	2.95
GALT	5.66	1.02	6.49	3.22	9.09	16.04	5.10
KITCHENER	3.50	1.02	5.50	4.20	0.34	14.56	3.19
PORT DOVER	10.34	1.02	9.10	3.19	4.56	28.22	-
PRESTON	3.95	1.02	4.37	2.68	0.32	12.34	5.40
S.S. MARIE	2.94	1.00	0.90	0.92	0.40	6.20	6.17
WATERLOO	4.38	1.00	4.15	2.99	1.08	13.54	4.53

OPERATING COSTS

The cost of operation of the sewage treatment plants used in this report include payroll of staff employed at the plants, fuel, power, chemicals, general supplies, equipment, repairs and maintenance, sundry, water and travel. The cost of head office supervision, including travel, accounting, purchasing and inspection is not charged against the project.

An explanation of items included in each of the categories of the operating costs follows:

1. Payroll
 - Regular: Staff salaries including pension, medical plan and Workmen's Compensation payments.
 - Casual: Salaries of labour employed on a temporary or part-time basis during staff shortages; or for part-time work. Workmen's Compensation payments are also included.
2. Fuel
 - Includes fuel oil, natural gas or propane used for heating.
3. Power
 - Includes hydro-electric power; and natural gas, gasoline, diesel fuel if used for power generators.
4. Chemicals
 - Includes chlorine, sodium hypochlorite, ferric chloride, hydrated lime, pickle liquor, odour control chemicals, vacuum filter and sewer cleaning chemicals (where applicable).
5. General Supplies
 - Includes laboratory reagents, laboratory equipment replacement, cleaning materials, lubricants, stationery, uniforms, light bulbs, instrument charts, books.
6. Equipment
 - Includes equipment to be used in the treatment process, laboratory, building, grounds, maintenance and small tools.
7. Repairs & Maintenance
 - Includes goods and services (excluding OWRC staff) used in the repair and maintenance of process, electrical equipment and buildings, inspections, packing materials, paints, etc.
8. Sundry
 - Includes express charges, telephone, telemetering, sludge haulage, insurance, taxes, etc.
9. Water
 - Includes all charges for water.
10. Travel
 - Includes operators travel to local hardware stores, railroad stations, conferences, conventions, etc. The cost of accomodation and meals associated with con-

ferences and conventions is also included.

The operating costs of 48 OWRC operated sewage treatment plants are summarized in Tables XVII to XXV inclusive. The plants are grouped according to the type of treatment: primary, conventional activated sludge or extended aeration. Frankford, a small trickling filter plant, is listed after the conventional activated sludge plants.

Tables XVII, XVIII and XIX, summarize the 1966 operating costs under each of the 11 budget categories for each plant. The four major cost areas; labour, power, repair and maintenance and sludge disposal are further described in Tables XX, XXI and XXII as percentages of the total operating costs and cost per million gallons of sewage treated.

Labour costs, including casual labour, accounted for the largest portion of the operating costs, averaging 46.7 percent for the primary treatment plants, 48.0 percent for conventional activated sludge plants and 50.2 percent for extended aeration plants, yielding costs of \$32.21, \$45.26 and \$112.20 respectively per million gallons treated.

Power costs for primary treatment plants averaged 15.3 percent of the costs and \$11.45 per million gallons, for conventional activated sludge plants, 13 percent and \$12.21 per million gallons, and for extended aeration plants, 23.7 percent and \$50.03 per million gallons. The power costs vary widely due to the diversity of equipment and in some cases to the use of electric heating in the buildings.

Maintenance, excluding plant staff labour, averaged 4.1 percent of the operating costs and \$2.40 per million gallons treated for primary plants, 5.1 percent and \$4.99 per million gallons for conventional activated sludge plants, and 3.4 percent and \$4.93 for extended aeration plants. The highest average maintenance costs occurred in conventional activated sludge plants where there is the largest amount of equipment to be maintained.

TABLE XVII

OPERATING COSTS - 1966
PRIMARY PLANTS

PROJECT	TOTAL	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEM.	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINT.	SUNDRY	WATER	TRAVEL
BELLEVILLE	51,664.78	16,481.58	789.46	2,450.35	7,467.53	2,175.28	1,367.65	305.57	2,228.59	14,407.15	5,471.35	554.89
FORT ERIE	26,123.29	10,771.51	814.34	635.78	4,144.95	1,050.49	1,455.93	759.91	371.34	4,338.19	3,471.35	540.71
FORT FRANCES	32,057.25	16,344.51		2,552.06	5,125.21	2,195.18	1,515.83	397.79	555.27	2,189.50	505.50	545.23
FORT WILLIAM	53,960.73	25,551.71	2,465.50	2,387.57	3,175.04	2,117.57	2,198.96	244.44	1,324.50	5,753.70	145.80	503.54
MIDLAND	20,708.17	10,728.53	614.87	1,121.35	2,084.14	1,023.50	1,185.93	357.52	513.75	2,317.12	205.24	370.42
OWEN SOUND	36,765.62	18,920.10		1,060.75	4,714.04	1,470.10	1,045.35	453.72	1,573.53	4,592.22	2,021.55	502.42
PARRY SOUND	25,281.93	9,331.28		1,342.35	5,875.40	2,335.55	1,257.54	280.41	872.55	1,555.50	569.54	219.53
POINT EDWARD	12,800.22	5,735.25	638.53	1,114.55	1,095.10	1,452.10	535.21	541.59	232.53	1,097.54	44.52	182.25
PORT ARTHUR	49,555.84	17,422.90	5,135.74	2,023.27	5,580.32	4,782.23	1,701.05	1,217.31	3,053.19	5,571.02	1,073.24	433.42
PORT DOVER	23,641.32	10,871.56	80.15			5,178.54	832.09	447.37	423.93	1,950.51	2,359.29	266.34
S.S. MARIE	125,132.15	57,595.40	2,257.77	1,322.51	16,171.10	10,459.44	5,157.51	1,851.37	8,217.59	22,747.24		932.14
TIMMINS	31,547.82	15,782.58	153.51	1,792.13	4,508.15	2,549.14	1,537.49	412.21	1,455.10	3,352.53		584.33
TRENTON	19,154.53	7,501.59	355.78	830.02	2,573.36	2,723.13	771.18	251.93	1,599.53	979.09	708.54	529.21

OPERATING COSTS - 1966

TABLE XVIII

CONVENTIONAL ACTIVATED SLUDGE PLANTS

PROJECT	TOTAL	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIP.	REPAIRS & MAINT.	SUNDRY	WATER	TRAVEL
GRANTFORD	188,857.51	106,153.14	4,723.74	1,304.10	26,132.51	23,685.86	5,035.73	2,573.00	5,814.87	9,542.20	2,329.23	975.13
BRANTON-CHINGUACOUSY	75,514.00	23,753.95	4,790.11		5,804.88	5,416.25	1,146.90	467.29	1,636.73	27,878.67	3,045.98	773.24
BURLINGTON D.L.	38,565.75	15,980.70	1,155.77	267.27	7,279.53	2,897.68	906.24	96.34	2,127.19	7,640.45	147.00	87.58
BURLINGTON E.G.	23,894.31	12,829.62		526.69	2,733.46	1,392.77	1,024.02	275.79	1,244.93	2,803.01	842.34	217.68
CHATHAM	89,625.37	43,639.63	740.21	2,910.98	17,498.03	5,122.95	3,407.01	6,787.92	2,131.41	4,866.31	1,760.50	660.37
CONISTON	11,578.81	5,523.66	1,176.18	625.85	1,202.22	346.51	421.13	124.07	820.20	407.18		931.81
ELMIRA	45,931.52	16,374.77	7,511.76	1,545.73	3,392.75	1,144.75	2,436.31	1,254.07	2,854.55	6,813.68	1,006.30	1,596.94
FERGUS	20,582.17	9,627.51		981.41	1,182.30	1,669.43	524.99	158.40	1,122.22	4,222.56	730.84	262.41
FRANKFORD	5,515.77	3,511.08			433.28	280.04	194.58	254.35	271.94	372.84		297.66
GALT	83,578.97	38,251.12	4,003.72	2,022.15	7,621.84	13,020.24	2,640.86	2,385.98	6,694.51	4,820.45	1,521.21	596.89
GEORGETOWN	38,306.82	16,519.67	2,215.80	1,694.15	3,323.31	1,478.71	1,310.93	327.41	3,587.53	6,850.98		897.13
HUNTSVILLE	10,925.38	5,144.45	532.44	472.17	1,614.59	283.50	423.60	125.58	705.60	1,234.65	194.80	194.00
KINGSTON	25,674.25	10,784.05	1,181.26	944.33	5,732.07	662.30	937.59	525.82	3,019.58	1,578.36		308.89
KITCHENER	279,143.47	101,373.23	10,210.06	4,808.54	29,434.53	62,430.05	5,516.07	2,953.27	12,659.86	48,838.59	106.38	812.89
LAKEVIEW	156,970.50	53,272.89	2,191.66	119.56	19,114.37	12,024.23	4,118.36	1,981.25	4,461.88	58,682.85	689.55	313.90
MARKHAM V.	17,931.30	10,369.06		293.42	2,492.86	996.49	585.62	468.56	557.40	1,272.43	663.87	231.59
NEPEAN TWP.	33,588.90	15,222.41	738.36	818.33	7,329.12	2,029.30	1,443.05	367.45	3,899.88	1,402.48		338.51
NEWMARKET	38,546.14	15,992.85	1,197.65	462.46	6,499.26	1,980.97	1,070.09	908.86	1,446.86	8,375.15	208.00	403.99
NORTH BAY	37,375.11	38,925.60	3,303.83	6,375.02	6,528.21	1,598.44	3,450.73	773.32	5,560.11	18,915.99	1,523.40	430.56
ORANGEVILLE	14,956.60	5,509.53		98.17	1,450.99	2,115.26	325.29	543.85	360.14	4,400.76		52.61
PORT COLBORNE	65,868.62	43,147.81	1,489.20	1,522.47	9,536.34	1,188.81	2,798.45	311.47	1,333.91	3,824.07	249.44	466.65
PRESTON	43,359.79	17,139.26	1,171.57	490.64	4,289.21	10,407.39	1,016.04	1,025.13	1,394.52	5,567.75	510.15	348.13
RICHMOND HILL	51,338.70	20,994.88	775.08	931.38	6,557.37	5,602.05	1,308.05	219.09	1,080.58	13,430.80		429.42
SIDNEY TWP.	6,812.13	3,090.20		807.56	863.70	580.52	224.39	113.19	0.61	575.41		556.55
SIMCOE	42,874.24	20,287.15	607.23	498.60	9,548.94	2,202.06	1,758.02	532.83	4,873.67	1,658.98	740.94	347.82
STRATFORD	59,148.93	31,344.99	1,291.60	178.05	5,669.39	197.68	2,837.82	928.49	3,838.31	11,985.21	578.94	298.45
STREETSVILLE	16,479.72	5,555.84	1,585.74	757.09	1,511.96	1,215.86	374.33	202.79	396.66	4,261.64	387.11	190.70
TILLSONBURG	27,281.70	10,479.05	37.00	1,453.84	4,830.61	1,048.51	1,103.45	235.78	1,568.86	6,010.30	169.39	344.91
WATERLOO	120,343.71	43,518.23	1,316.82	1,876.36	23,751.93	11,356.45	2,872.31	1,299.51	3,599.84	30,028.98		723.28

OPERATING COSTS - 1966

EXTENDED AERATION PLANTS

TABLE XIX

PROJECT	TOTAL	PAYROLL	CASUAL		FUEL	POWER	CHEMICAL	GENERAL		REPAIRS & MAINT.	SUNDRY	WATER	TRAVEL
			PAYROLL					SUPPLIES	EQUIP.				
BURLINGTON -SKYWAY	59,744.34	21,374.87	2,448.89		21,728.22	1,313.32	2,242.94	707.52	1,854.30	7,285.58	312.13	476.57	
ELORA	6,508.59	3,780.90			1,294.54	141.75	250.42	42.30	33.26	640.17		325.25	
MOORE TWP.	1,1851.63	5,381.68	613.67		3,551.18	322.80	570.96	76.75	275.67	785.99	109.52	163.41	
PARIS	1,0267.83	5,161.69	50.75	105.41	1,650.55	525.75	290.29	110.87	740.95	996.79	95.08	539.70	
WESTMINISTER	1,3449.12	5,591.54	1,341.88		2,195.79	264.61	307.78	2,238.42	509.80	839.15		160.15	

OPERATING COSTS - 1966

TABLE XX

PRIMARY PLANTS

PROJECT	TOTAL OPERATING COSTS	LABOUR COSTS			POWER COSTS			MAINTENANCE		SLUDGE DISPOSAL		
		TOTAL	% OF TOTAL	\$ PER M.G.	TOTAL	% OF TOTAL	\$ PER M.G.	TOTAL	% OF TOTAL	TOTAL	% OF TOTAL	\$ PER M.G.
BELLEVILLE	51,664.78	17,251.13	33.4	8.65	7,467.53	14.5	3.75	2,283.89	4.4	1,580.40	3.1	0.79
FORT ERIE	26,123.29	11,586.15	44.4	19.20	4,144.95	15.9	6.87	971.34	3.7	711.24	2.7	1.18
FORT FRANCES	32,057.25	16,344.51	51.0	21.44	5,129.21	16.0	6.73	1,633.27	2.0	992.00	3.1	1.30
FORT WILLIAM	53,980.73	28,357.31	52.5	28.49	9,178.94	17.0	9.22	1,324.50	2.5	1,922.40	3.6	1.93
MIDLAND	20,703.17	11,403.20	55.1	31.01	2,084.14	10.1	5.67	613.75	3.0	1,315.40	6.4	3.58
OWEN SOUND	36,763.62	18,920.10	51.5	16.22	4,714.04	12.8	4.04	1,979.59	5.4	2,984.10	8.1	2.56
PARRY SOUND	25,231.98	9,331.28	36.9	40.28	6,875.40	27.2	29.68	872.86	3.5	NIL		
POINT EDWARD	12,800.22	6,435.51	50.3	84.77	1,093.10	8.5	14.40	232.58	1.8	334.80	2.6	4.41
PORT ARTHUR	49,556.84	23,616.64	47.6	12.94	6,053.67	12.2	3.52	3,085.19	6.2	4,173.40	8.4	2.29
PORT DOVER	23,641.32	10,951.82	46.3	85.76	5,588.32	23.6	43.70	423.93	1.8	NIL		
SAULT STE. MARIE	126,102.15	59,353.17	47.1	22.24	16,171.10	12.8	6.06	6,517.69	5.2	11,935.60	9.5	4.47
TIMMINS	31,647.82	15,946.19	50.4	14.10	4,508.15	14.2	3.99	1,466.10	4.6	NIL		
TRENTON	19,154.53	7,868.37	41.1	33.66	2,673.36	14.0	11.44	1,699.63	8.9	NIL		
AVERAGE			46.7	32.21		15.3	11.45		4.1		5.3	2.50

TABLE XXI

OPERATING COSTS - 1966
CONVENTIONAL ACTIVATED SLUDGE PLANTS

PROJECT	TOTAL OPERATING COSTS	LABOUR COSTS			POWER COSTS			MAINTENANCE			SLUDGE DISPOSAL		
		TOTAL	% OF TOTAL	\$ PER M. G.	TOTAL	% OF TOTAL	\$ PER M. G.	TOTAL	% OF TOTAL	\$ PER M. G.	TOTAL	% OF TOTAL	\$ PER M. G.
BRANTFORD	188,867.51	110,876.88	58.7	44.52	26,132.51	13.8	10.49	5,814.87	3.1	2.33	6,500.00	3.4	2.61
BRAMPTON	75,514.00	28,544.06	37.8	29.84	5,804.88	7.7	6.07	1,635.73	2.2	1.71	22,781.05	30.2	23.82
BURLINGTON D.O.	38,556.75	17,115.47	44.4	29.59	7,279.53	18.9	12.59	2,127.19	5.5	3.58	5,793.57	15.0	10.02
BURLINGTON E.G.	23,894.31	12,829.62	53.7	43.09	2,733.46	11.4	9.13	1,244.93	5.2	4.13	2,188.33	9.2	7.35
CHATHAM	89,825.37	44,379.84	49.5	61.89	17,498.08	19.5	24.40	2,131.41	2.4	2.97	NIL	-	-
CONISTON	11,578.81	6,699.84	57.9	106.11	1,202.22	10.4	19.04	820.20	7.1	12.99	NIL	-	-
ELMIRA	45,931.52	23,886.53	52.0	117.74	3,332.75	7.4	16.72	2,334.55	6.2	14.07	3,860.00	8.4	15.03
FERGUS	20,582.17	9,627.61	46.8	43.95	1,152.30	5.7	5.40	1,122.22	5.5	5.12	3,515.13	17.5	16.50
FRANKFORD	5,515.77	3,511.03	62.5	-	433.28	7.7	-	271.94	4.8	-	NIL	-	-
GALT	83,578.97	42,254.84	50.8	22.19	7,621.34	9.1	4.00	6,894.51	8.0	3.52	3,192.06	3.8	1.68
GEORGETOWN	38,306.82	16,735.67	43.6	51.55	3,323.31	8.7	9.14	3,687.53	9.6	10.15	4,411.80	11.5	12.14
HUNTSVILLE	10,925.39	5,676.39	52.0	58.25	1,514.59	14.5	16.57	705.60	6.5	7.24	632.40	5.8	6.49
KINSTON TWP.	25,574.25	11,965.31	46.8	64.09	5,732.07	22.3	30.70	3,018.58	11.8	16.17	NIL	-	-
KITCHENER	273,143.47	111,583.29	40.6	32.27	29,434.53	10.5	8.51	12,650.86	4.5	3.65	31,731.49	11.4	9.18
LAKEVIEW	159,970.50	55,464.55	35.3	19.02	19,114.37	12.2	6.57	4,461.83	2.8	3.20	49,861.32	31.2	17.15
MARKHAM VILLAGE	17,931.30	10,363.06	57.3	59.48	2,492.96	13.9	14.30	567.40	3.1	3.20	NIL	-	-
NEPEON TWP.	33,588.90	15,960.77	47.5	15.80	7,329.12	21.8	7.25	3,899.88	11.6	2.64	4,965.30	12.9	9.07
NEWMARKET	38,548.14	17,190.50	44.8	31.40	6,439.25	16.9	11.87	1,446.85	3.8	4.00	14,215.77	16.3	10.25
NORTH BAY	87,375.11	42,229.43	48.3	30.46	1,450.99	9.7	6.93	360.14	2.4	1.95	4,000.00	26.7	19.09
ORANGEVILLE	14,856.50	5,509.53	36.8	26.30	9,336.34	14.5	13.97	1,333.91	2.4	1.72	1,753.92	2.7	2.57
PORT COLBORNE	65,868.52	44,637.01	67.8	65.37	4,289.21	9.9	12.73	1,394.52	3.2	4.14	4,376.70	10.1	12.99
PRESTON	43,359.79	18,310.83	42.2	54.54	6,567.37	12.8	11.07	1,080.58	2.1	1.82	11,400.49	22.2	19.21
RICHMOND HILL	51,338.70	21,769.96	42.4	36.58	863.70	12.6	12.91	0.61	<0.1	-	217.52	3.2	3.23
SIMCOE	6,812.13	3,090.20	45.4	45.34	9,548.09	22.3	15.20	4,873.67	11.4	7.76	NIL	-	-
STRAITFORD	42,874.24	20,894.38	48.7	33.25	5,668.39	9.6	5.06	3,838.31	6.5	3.42	10,337.50	17.5	9.22
STRETSVILLE	59,148.93	32,636.59	55.2	29.12	1,511.96	9.2	7.58	336.66	2.4	1.99	3,743.40	22.7	18.77
TILLSONBURG	16,479.72	7,191.53	43.8	39.00	4,830.61	17.7	18.11	1,568.86	5.8	5.88	5,076.50	15.6	19.04
WATERLOO	27,281.70	10,516.05	38.5	39.43	23,751.93	13.7	20.84	3,599.84	3.0	3.16	23,612.06	19.6	20.71
AVERAGE			48.0	45.26		13.0	12.21		5.1	4.99		14.7	12.28

OPERATING COSTS - 1966

EXTENDED AERATION PLANTS

TABLE XXII

PROJECT	TOTAL OPERATING COSTS	LABOUR COSTS			POWER COSTS			MAINTENANCE			SLUDGE DISPOSAL		
		TOTAL	% OF TOTAL	\$ PER M. G.	TOTAL	% OF TOTAL	\$ PER M. G.	TOTAL	% OF TOTAL	\$ PER M. G.	TOTAL	% OF TOTAL	\$ PER M. G.
BURLINGTON SKY.	59,744.34	23,023.76	39.9	23.55	21,728.22	36.4	21.48	1,854.30	3.1	1.33	5,353.14	9.0	5.29
ELORA	6,508.59	3,780.90	58.1	208.40	1,294.54	19.9	71.36	33.26	0.5	1.33	NIL	-	-
MOORE TWP.	11,851.63	5,995.35	50.6	192.77	3,551.18	30.0	114.18	275.57	2.3	8.86	NIL	-	-
PARIS	10,257.83	5,212.44	50.8	30.57	1,650.55	16.1	9.71	740.95	7.2	4.36	NIL	-	-
WESTMINSTER	13,449.12	6,933.42	51.6	105.59	2,195.79	16.3	33.44	509.80	3.8	7.76	200.00	1.5	3.05
AVERAGE			50.2	112.20		23.7	50.03		3.4	4.93		5.2	4.17

Sludge disposal, where haulage costs are available, accounted for 5.3 percent of the operating costs and \$2.50 per million gallons in primary plants, 14.7 percent and \$12.28 per million gallons in conventional activated sludge plants, and 5.2 percent and \$4.17 per million gallons in extended aeration plants. The highest sludge disposal costs are incurred by the conventional activated sludge plants since they remove a larger portion of the sewage solids for subsequent disposal.

Tables XXIII, XXIV and XXV summarize the operating cost per unit of sewage treated. For primary treatment plants, the average cost is \$69.27 per million gallons, \$0.109 per lb. of BOD removed and \$0.073 per lb. of suspended solids removed. These costs for conventional activated sludge plants are \$93.25, \$0.063 and \$0.057 respectively and for extended aeration plants, \$212.82, \$0.144 and \$0.099.

Figures No. 14 and 15 show a statistically derived regression line by the least squares method, representing the total operating cost for various design capacities. Also shown are the limits of one standard deviation on each side of the regression line. Figure No. 14 represents primary treatment plants and Figure No. 15 conventional activated sludge secondary treatment plants.

OPERATING COSTS

TABLE XXIII

1966

PRIMARY PLANTS

PROJECT	DESIGN CAPACITY	OPERATING COST	COST/ M.G. \$	COST / LB. B.O.D. REM'D \$	COST / LB. S.S. REM'D \$
BELLEVILLE	3,000	51,664.78	25.91	0.079	0.035
FORT ERIE	1,800	26,123.29	43.29	0.188	0.088
FORT FRANCES	2,000	32,057.25	42.05	0.114	0.047
FORT WILLIAM	6,000	53,980.73	54.22	0.159	0.159
MIDLAND	1,250	20,703.17	56.29	0.073	0.066
OWEN SOUND	3,000	36,763.62	31.52	0.055	0.025
PARRY SOUND	0,830	25,281.98	109.14	0.227	0.113
POINT EDWARD	0,570	12,800.22	168.61	0.213	0.108
PORT ARTHUR	4,000	49,656.84	27.20	0.030	0.015
PORT DOVER	2,100	23,641.32	185.12	0.101	0.161
SAULT STE. MARIE	8,000	126,102.15	47.25	0.105	0.052
TIMMINS	3,000	31,647.82	27.98	0.022	0.022
TRENTON	1,000	19,154.53	81.94	0.047	0.060
AVERAGE			69.27	0.109	0.073

OPERATING COSTS

1966

TABLE XXIV

CONVENTIONAL ACTIVATED SLUDGE PLANTS

PROJECT	DESIGN CAPACITY	OPERATING COST	COST / M.G. \$	COST / LB. B.O.D. REM'D \$	COST / LB. S.S. REM'D \$
BRANTFORD	12,500	188,867.51	75.83	0.039	0.034
BRAMPTON/CHINGUACOUSY	2,000	75,514.00	78.94	0.022	0.011
BURLINGTON DL	2,500	38,565.75	66.67	0.030	0.022
BURLINGTON E6	0.750	23,894.31	80.25	0.075	0.057
CHATHAM	4,500	89,625.37	124.99	0.051	0.066
CONISTON	0.260	11,578.81	183.39	0.105	0.105
ELMIRA	0.680	45,931.52	226.40	0.094	0.238
FERGUS	0.600	20,582.17	93.96	0.040	0.059
*FRANKFORD	0.270	5,815.77	-	-	-
GALT	5,000	83,578.97	43.90	0.029	0.027
GEORGETOWN	1,500	38,306.82	105.39	0.146	0.057
HUNTSVILLE	0.250	10,925.38	112.09	0.081	0.110
KINGSTON	0.830	25,674.25	137.52	0.074	0.069
KITCHENER	13,500	279,143.47	80.73	0.036	0.025
LAKEVIEW	5,000	156,970.50	53.99	0.025	0.021
MARKHAM VILLAGE	0.334	17,931.30	102.86	0.073	0.055
NEPEAN TOWNSHIP	1,500	33,588.90	33.24	0.158	0.083
NEWMARKET	2,000	38,546.14	70.41	0.037	0.017
NORTH BAY	4,000	87,375.11	63.02	0.059	0.044
ORANGEVILLE	0.750	14,956.60	71.39	0.073	0.060
PORT COLBORNE E	0.850				
PORT COLBORNE W	0.900	65,868.62	96.46	0.126	0.101
PRESTON	1,800	43,359.79	128.68	0.029	0.022
RICHMOND HILL	1,600	51,338.70	86.51	0.054	0.035
SIDNEY TOWNSHIP	0.120	6,812.13	101.04	0.153	0.109
SIMCOE	2,000	42,874.24	68.23	0.029	0.032
STRATFORD	4,000	59,148.93	52.77	0.022	0.021
STREETSVILLE	0.800	16,479.72	86.62	0.023	0.026
TILLSONBURG	0.665	27,281.70	102.30	0.048	0.048
WATERLOG	4,000	120,343.71	105.58	0.037	0.046
AVERAGE			93.25	0.063	0.057

TABLE XXV

EXTENDED AERATION PLANTS

PROJECT	DESIGN CAPACITY	OPERATING COST	COST / M.G. \$	COST / LB. B.O.D. REM'D \$	COST / LB. S.S. REM'D \$
BURLINGTON SKYWAY	3.125	59,744.34	59.07	0.033	0.030
ELORA	0.083	6,508.59	358.76	0.157	0.079
MOORE TOWNSHIP	0.320	11,851.63	381.06	0.237	0.214
PARIS	0.500	10,267.83	60.41	0.044	0.043
WESTMINSTER	0.250	13,449.12	204.81	0.247	0.130
AVERAGE			212.82	0.144	0.099

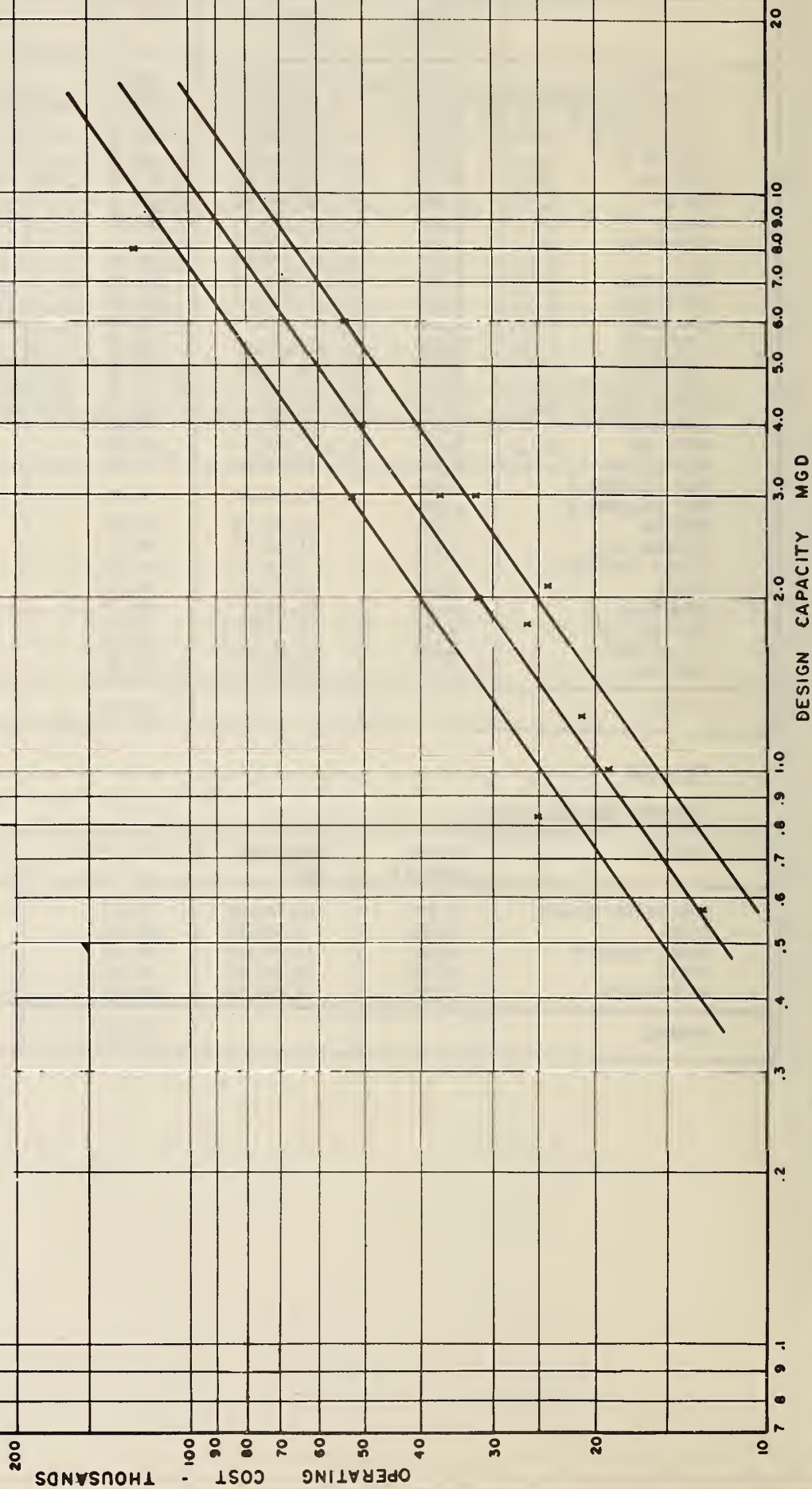
FIG. No. 14

1966 OPERATING COSTS
PRIMARY TREATMENT PLANT
OPERATING COST (1000'S OF DOLLARS)

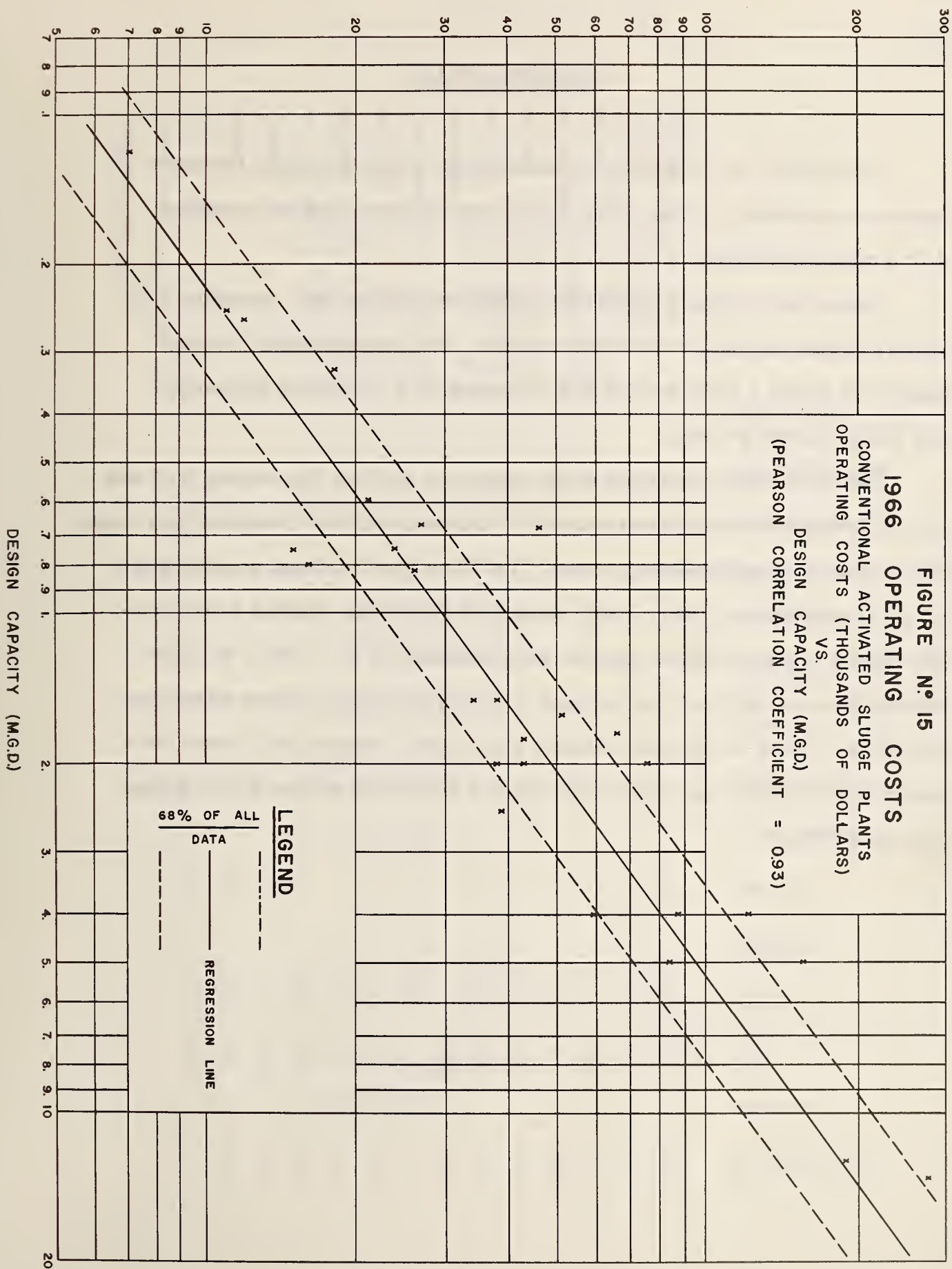
VS

DESIGN CAPACITY (MGD)

PEARSON CORRELATION COEFF. = 0.92



OPERATING COSTS (THOUSANDS OF DOLLARS)



OPERATING STAFF

During 1966, the 13 primary treatment plants and 35 secondary treatment plants were operated by a total of 199.5 permanent employees and the equivalent of 19.5 casual employees.

Ten of the 13 primary plants were staffed one shift per day, averaging 1.56 men per million gallons per day design capacity. The remaining three primary plants were staffed 2 shifts per day with an average of 1.15 men per million gallons design capacity per day.

The 25 secondary treatment plants staffed one shift per day average 3.52 men per million gallons design capacity per day. Since some of these plants are very small, the complement is correspondingly large. The Elora plant, although employing only 0.8 men during the year, has a design capacity of 83,000 gpd, yielding a staff complement of 9.6 men per million gallons design capacity per day. The 5 secondary plants staffed two shifts per day averaged 2.64 men per million gallons design capacity per day. Since the two Port Colborne plants have a common staff, there are 4 plants staffed 3 shifts a day with an average of 2.48 men per million gallons design capacity per day.

TABLE XXV 1

OPERATING STAFF
PRIMARY TREATMENT PLANTS

	SUPERINTENDENT	ASS. SUPERINTENDENT	CHIEF OPERATOR	FOREMAN	PLANT MECHANIC	PLANT ELECTRICIAN	LAB TECHNICIAN	FILTER OPERATOR	SENIOR OPERATOR	OPERATOR	GROUNDSMAN	CASUAL	TOTAL	SHIFTS PER DAY	NO. MEN/MGD DESIGN
BELLEVILLE			1		1+					2		0.2	4.2	1	1.4
FORT ERIE			1							1		0.2	2.2	1	1.2
FORT FRANCES			1							2			3.0	1	1.5
FORT WILLIAM			1		1					3		0.7	5.7	2	0.95
MIDLAND			1							1		0.2	2.2	1	1.8
OWEN SOUND			1							2	1		4.0	1	1.3
PARRY SOUND			1							1			2.6	1	2.4
POINT EDWARD			1									0.1	1.1	1	1.9
PORT ARTHUR			1		1					1		1.6	4.6	2	1.2
PORT DOVER			1							1		0.1	2.1	1	1.0
SAULT STE. MARIE	1				2			1		5	1	0.6	10.6	2	1.3
TIMMINS			1							2		0.1	3.1	1	1.0
TRENTON*			0.9							0.5		0.1	2.1	1	2.1
TOTAL	1		11.9		5		1			21.5	2	3.9	46.3		

* JOINTLY OPERATED WITH SIDNEY TWP.

* OPERATOR * MECHANIC

OPERATING STAFF

TABLE XXVII

SECONDARY TREATMENT PLANTS

1966

CLASSIFICATION

PROJECT	SUPERINTENDENT	ASST. SUPERINTENDENT	CHIEF OPERATOR	FOREMAN	MECHANIC	ELECTRICIAN	LAB. TECHNICIAN	FILTER OPERATOR	SENIOR OPERATOR	OPERATOR	GROUNDS/JANIT.	CASUAL	TOTAL	SHIFTS / DAY	NO. MEN / MGD DESIGN
BRAMPTON	1	1								4		1.0	7.0	1	3.5
BRANTFORD	1	1		6	2		1	2		5	2	1.0	21.0	3	1.7
BURLINGTON DL									1	1		0.3	2.3	1	0.9
BURLINGTON EG									1	1		-	2.0	1	2.7
BURLINGTON SKY	1				1					3		0.6	5.6	1	1.8
CHATHAM	1	1			2		1			4	1	0.2	10.2	2	2.3
CONISTON			1									0.7	1.7	1	6.5
ELMIRA			1							2		2.0	5.0	1	7.3
ELORA*			0.5							0.3		-	0.8	1	9.6
FERGUS*			1							0.7		-	1.7	1	2.8
GALT			1		1					4	1	1.0	8.0	2	1.6
GEORGETOWN			1		1					1		0.6	3.6	1	2.4
HUNTSVILLE			1									0.2	1.2	1	4.8
KINGSTON TWP.			1							2		0.5	3.5	1	4.2
KITCHENER	1	1		1	1	1		5		6	2	2.5	21.5	3	1.6
LAKEVIEW	1		1	1	3		1			5	4	0.6	16.6	2	3.3
MARKHAM VILL.			1							1		-	2.0	1	6.0
MOORE TWP.			1									0.2	1.2	1	3.8
NEPEAN TWP.			1							2		0.2	3.2	1	2.1
NORTH BAY	1				1	1+				4		0.8	7.8	2	3.9
ORANGEVILLE			1									-	1.0	1	1.3
PARIS			1									-	1.0	1	2.0
PORT COLBORNE E	1				1					6		0.8	8.8	3	5.0
PORT COLBORNE W												-	-		
PRESTON			1							2		0.3	3.3	1	1.8
RICHMOND HILL			1							3		0.2	4.2	1	2.6
SIDNEY TWP.**			0.1							0.5		-	0.6	1	5.0
SIMCOE			1		1					1	1	0.2	4.2	1	3.0
STRATFORD			1							5		0.3	6.3	3	1.6
STREETSVILLE			1									0.5	1.5	1	1.9
TILLSONBURG			1							1		-	2.0	1	3.0
WATERLOO			1		1					6		0.3	8.3	2	2.1
WESTMINSTER			1									0.4	1.4	1	5.6
FRANKFORD										1		-	1.0	1	1.9
NEWMARKET			1							2		0.2	3.2	1	1.6
TOTAL	8	4	22.6	8	15	2	4	2	7	73.8	11	15.6	172.7		

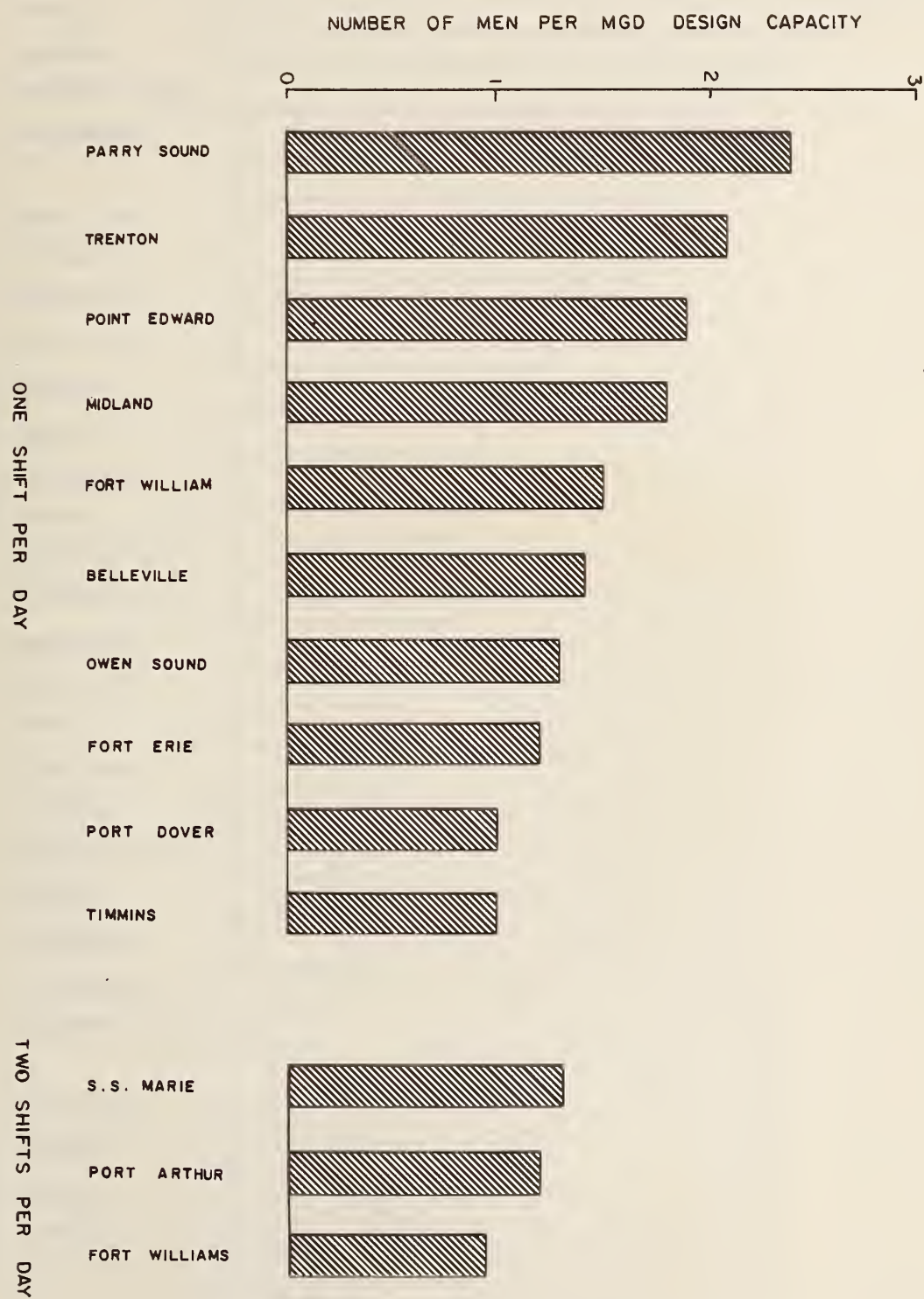
* ELORA OPERATED BY STAFF OF FERGUS WPCP JULY - DECEMBER 1966

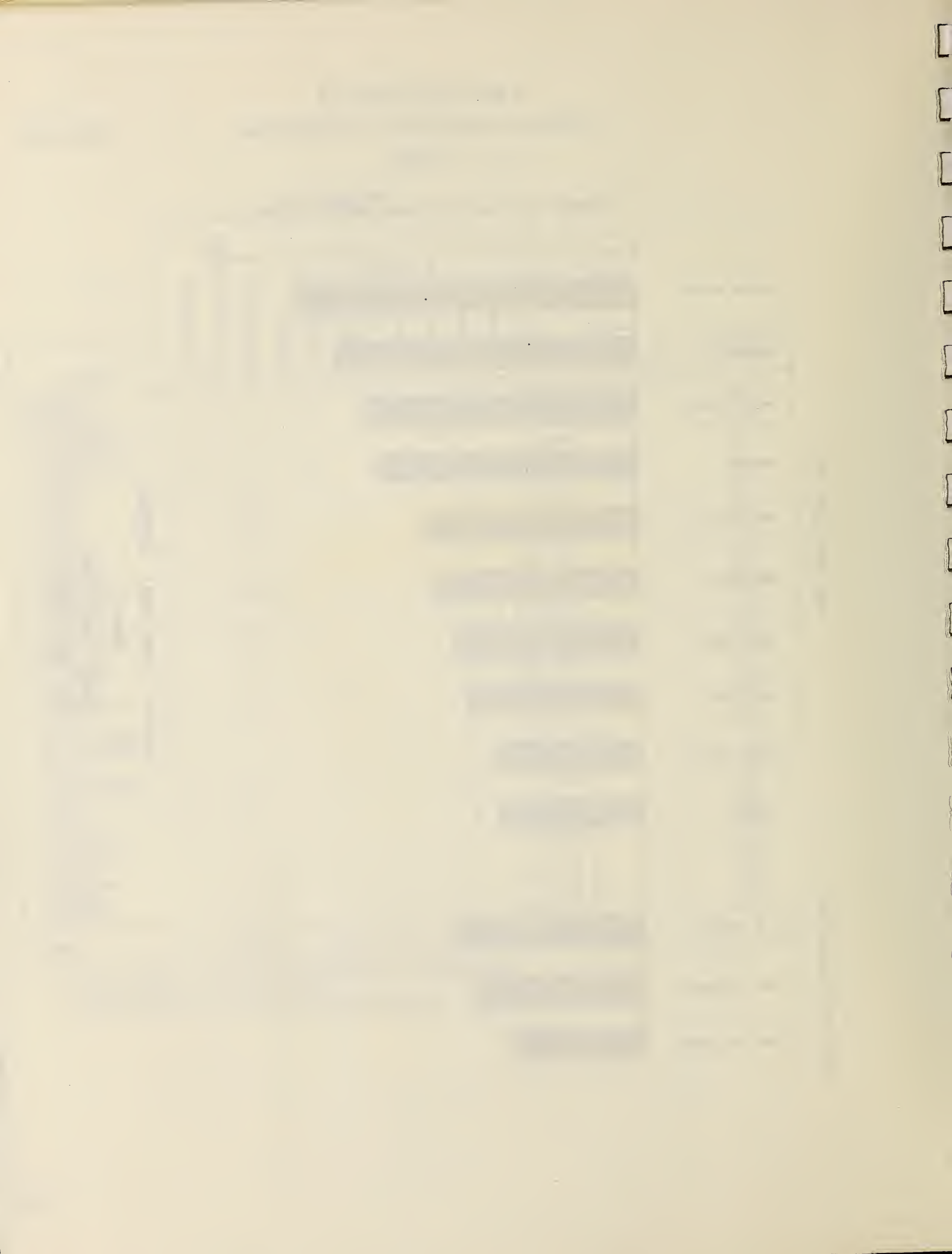
** JOINTLY OPERATED WITH TRENTON WPCP

+ PLANT ELECTRICIAN IS ALSO ASSISTANT SUPERINTENDENT

FIGURE No. 16
OPERATING STAFF
1966

PRIMARY TREATMENT PLANTS





NUMBER OF MEN PER MGD DESIGN CAPACITY

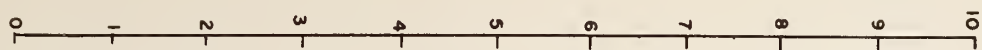
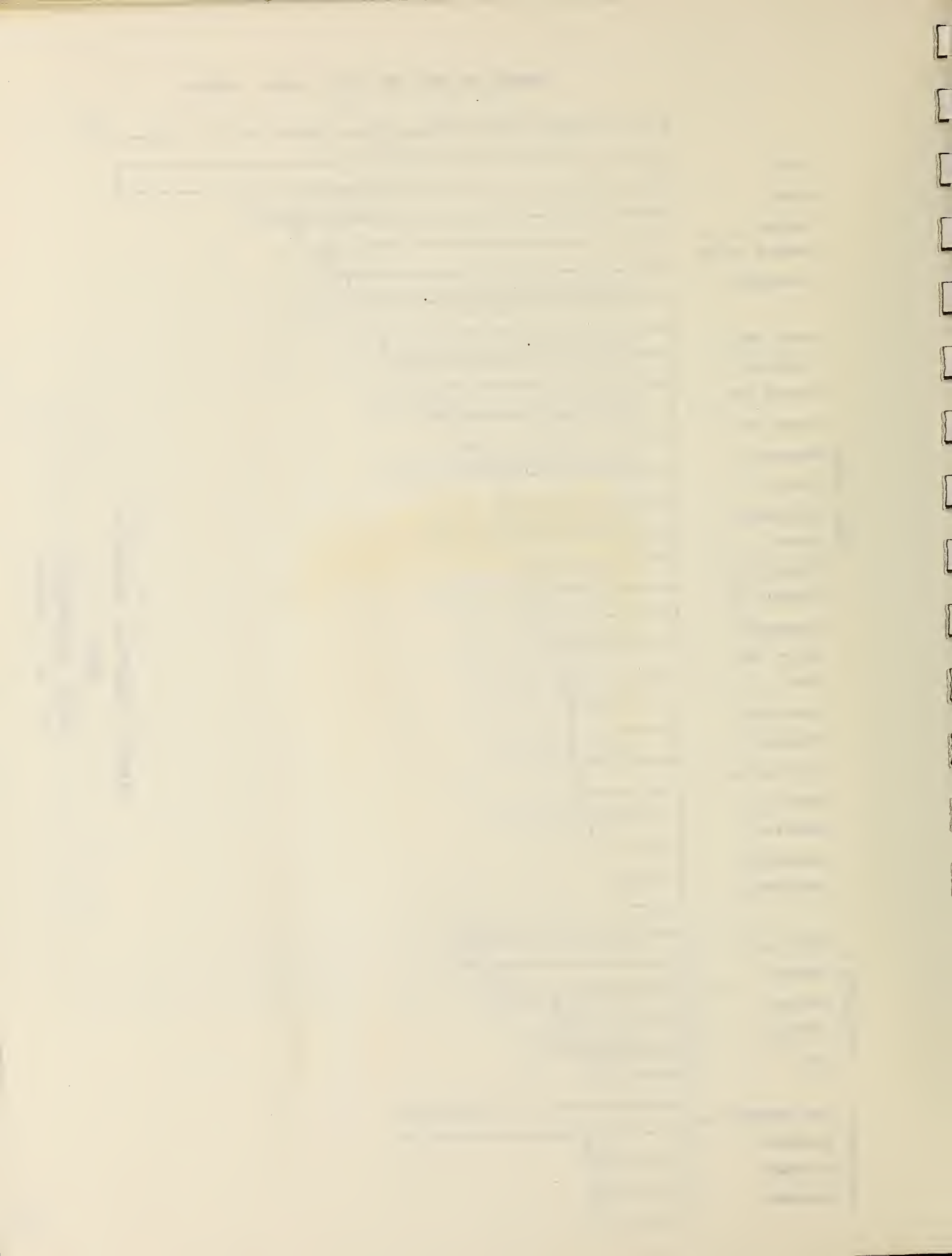


FIGURE No. 17
OPERATING STAFF
1966
SECONDARY TREATMENT PLANTS

1 SHIFT / DAY

2 SHIFTS / DAY

3 SHIFTS / DAY



Date Due

TD
367
.A56
064
1966

1966 operating summary :
water pollution control plants.
81560



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